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SYSTEMATICS AND DISTRIBUTION OF THE WINTER STONEFLY GENUS *CAPNIA* (PLECOPTERA: CAPNIIDAE) IN NORTH AMERICA

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ABSTRACT.—The genus *Capnia* in North America is reviewed and compared to other genera in the family. The genus is divided into 10 species groups. A key to the 51 species of *Capnia* in North America is given along with a listing of type localities, type repositories, diagnoses, and distributions. New illustrations of structures bearing characters important for identification and classification are presented. An annotation of the list of *Capnia* of North America given by Stark, Szczytko, and Baumann (1986) reflecting current generic placement of species is produced. From this list *Capnia bakeri* and *sugluka* are moved to *Mesocapnia*. *Capnia barbata* Frison is placed in synonymy under *Capnia decepta*. The movement of *cygna* (synonym of *venosa*), *elevata*, *fibula*, *manitoba*, *venosa*, and *wanica* to *Capnura* (Nelson and Baumann, 1987b) is noted. *Capnia disala* and *ensicala* are placed in *Paracapnia*.

The genus *Capnia* Pictet in North America consists of 51 species that may be divided into 10 morphologically defined species groups and a number of unplaced species. Pictet (1841) erected the genus *Capnia* to include his *Perla nigra* and *Capnia* (*Gripopteryx*) *cancelata*, *Semblis pygmaea* Burmeister, and *S. gracilis* Burmeister. Enderlein (1909) designated *C. nigra* as the type species of *Capnia* and accorded *Gripopteryx* generic status.

The history of North American species placed in *Capnia* begins with Banks's (1897) description of *Arsapnia decepta* based on material from Fort Collins, Colorado. Claassen (1924) synonymized *Arsapnia* under *Capnia*. Banks (1900) described *Capnura venosa*, and Hanson (1946) transferred it to *Capnia*. Nelson and Baumann (1987b) resurrected the genus *Capnura* to include *C. venosa*, *C. elevata*, *C. fibula*, *C. manitoba*, *C. wanica*, and two new species: *C. anas* and *C. intermontana*. Other significant works and workers dealing with the systematics and distribution of *Capnia* in North America are cited in the

synonymies of the individual species given below.

An examination of types of most North American species of *Capnia* revealed that certain species currently placed in *Capnia* better fit into other genera, as they are presently understood. Many species listed in *Capnia* in publications prior to 1986 are placed in different genera (often former subgenera) in Stark, Szczytko, and Baumann (1986). The following are annotations of the *Capnia* listed in Stark, Szczytko, and Baumann (1986), given in the order of their list (alphabetical by species):

Mesocapnia bakeri (Banks, 1918), originally described in *Arsapnia*; later moved to *Capnia* by Needham and Claassen (1925). Holotype examined, in MCZ. The holotype, a female, has the projection of the posterior margin of the subgenital plate, characteristic of *Mesocapnia*.

Capnia barbata Frison; placed in synonymy with *Capnia decepta* in this paper. Holotype examined, in INHS.

Capnura cygna (Jewett), originally described in *Capnia*; placed in synonymy with *Capnura venosa* (Banks) by Nelson and Baumann (1987b). Holotype examined, in CAS.

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Paracapnia disala (Jewett), originally described in *Capnia*; moved to *Paracapnia* by present designation. Holotype examined, in CAS. The holotype, a female, has lateral incisions separating the subgenital plate from the remainder of sternum 8, characteristic of *Paracapnia*. Additional male and female specimens collected from the type locality of Parker Creek, on Marys Peak in Benton Co., Oregon, support the transfer of this species.

Capnura elevata (Frison), originally described in *Capnia*; later moved to *Capnura* by Nelson and Baumann (1987b). Holotype examined, in INHS.

Paracapnia ensicala (Jewett), originally described in *Capnia*; moved to *Paracapnia* by present designation. Holotype examined, in CAS. The holotype, a male, has the base of the epiproct arching posteriorly in a narrow tube as in males of other species in the genus *Paracapnia*. This species is unique in having an irregular lateral expansion on the right side of the epiproct. This expansion appears to be a deformity. Additional specimens from the type locality (Washington, Thurston Co., Boston Harbor, 9 mi north Olympia, 3 January 1959, H. Hacker) are desirable to see if this irregularity is a deformity or a normal feature of the species.

Capnura fibula (Claassen), originally described in *Capnia*; later moved to *Capnura* by Nelson and Baumann (1987b). Holotype examined, in CU.

Capnura manitoba (Claassen), originally described in *Capnia*; later moved to *Capnura* by Nelson and Baumann (1987b). Holotype examined, in CNC.

Mesocapnia sugluka Ricker, originally described in *Capnia*; moved to *Mesocapnia* by present designation. Holotype examined, in CNC. The holotype, a female, has the projection of the posterior margin of the subgenital plate, characteristic of *Mesocapnia*.

Capnura venosa Banks; later moved by Hanson (1946) to *Capnia*. This species was returned to *Capnura* by Nelson and Baumann (1987b) and is the type-species of the genus. Holotype examined, in MCZ.

Capnura wanica (Frison), originally described in *Capnia*; later moved to *Capnura* by Nelson and Baumann (1987b). Holotype examined, in INHS.

Significant morphological differences exist in male and female terminalia between the type of the genus, *Capnia nigra* Pictet from Europe, and those species currently assigned to *Capnia* in North America. These differences are of the magnitude that many students of Plecoptera would recognize as generic-level, when compared to other groups of stoneflies. Separate genera may be useful in the division of this large plecopteran genus. Any division, however, should occur after a careful study of the genera on a worldwide scope to avoid problems of usage among workers in the Nearctic and the Palearctic regions.

North American members of the genus *Capnia* (sensu lato) may be divided into 10 monophyletic groups and an eleventh category that consists of species of uncertain placement. This last group contains several distinct subgroups and is undoubtedly polyphyletic. Further study of the generic status of *Capnia* as it relates to the genera of the world should help in classifying these enigmatic species. The groups in *Capnia* are defined using characters of the male terminalia and are generally supported by characters of the female subgenital plate.

MATERIALS AND METHODS

Collections of capniids from northern and western North America were borrowed from those individuals and institutions listed in the acknowledgments. Type localities or nearby sites were visited by the authors to obtain fresh specimens for as many species as possible. Fresh collections of 47 of the 51 species were obtained during collecting trips taken by the authors and various members of the Winter Stonefly Club.

Specimens of Capniidae are easiest to identify when collected and stored in 70% alcohol. Those specimens collected and curated by Claassen from 1920 to 1940 were usually adequately preserved. Alcohol specimens stored in cool environments were in much better condition than those that had experienced extreme heat. Specimens are in best condition when few individuals are placed in each vial. A rule of thumb used to ensure proper preservation is that a rough ratio of 4 parts alcohol to 1 part insect be maintained in storage vials.

Pinned, dried specimens were also examined. These specimens were prepared for viewing by removing the abdomen and relaxing it in a dilute solution of sodium phosphate tribasic. After the relaxed abdomen was viewed, it was placed in a plastic genitalia vial containing glycerin and pinned with the remainder of the specimen.

Specimens were examined and identified using a Wild M5 dissecting stereomicroscope and a Swift compound stereomicroscope. Selected specimens were prepared and viewed using an AMray scanning microscope following procedures outlined in Nelson and Baumann (1987a). Drawings were made using a camera lucida attachment on a Wild M8

dissecting microscope and consulting the scanning electron micrographs.

Much collecting of these interesting stoneflies has been done in the past; well over 20,000 specimens in the genus *Capnia* were examined during this study to determine species distributions. Several thousand specimens in related genera were examined as well to note variations in different genera. Several terms used in the keys are defined as follows: horns are lateral projections of the epiproct usually found on the distal third; they may be far from the tip as in *C. barberi* (Figs. 7, 8) or near the tip as in *C. decepta* (Figs. 35, 36). The neck of the epiproct is the narrow junction between the epiproct and the abdomen; often this area is constricted, separating the gibbous bulb of the epiproct from the main body. Compoundly curved refers to the sinuous shape of the epiproct, which curves forward, dips downward, and then returns upward (Figs. 40, 104). Sensillae are defined as simple sense organs or parts of compound sense organs. In this work they represent the setae and other projections of the tergal knobs of the abdomen (Fig. 174). Further terminology regarding morphology of capniids used in this study is given under the *Decepta* group, in Figures 209, 210, and in Nelson and Baumann (1987a-c).

Records of all specimens studied were kept. Available label data including state or province, county, locality, collecting date, and collectors, as well as any other miscellaneous information, were recorded. The detailed label information is recorded by species in log books in the possession of the senior author; a computer listing of these records is deposited in the insect collection of the M. L. Bean Life Science Museum at Brigham Young University.

Type repositories are listed in parentheses at the end of the holotype section of individual species treatments. The minimum number of specimens examined by the authors is given in parentheses at the end of the individual distribution sections. The seasonal distribution of each species is given as a range of the earliest to latest collecting dates following the number of specimens examined by the authors. This range of dates represents all collections of a given species throughout its geographical range. In general, *Capnia* emerge earliest at lower elevations and southerly latitudes and

emerge progressively later as elevation increases or as one proceeds north.

The following abbreviations are used in this text: CAS—California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118. CNC—Canadian Nation Collection, Biosystematics Research Centre, Ottawa, Ontario, Canada, K1A 0C6. Co.—County. CU—Cornell University, Ithaca, NY 14853. INHS—Illinois Natural History Survey, 607 East Peabody, Champaign, IL 61820. LACM—Los Angeles County Museum, Exposition Park, Los Angeles, CA 90007. MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138. USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

SYSTEMATICS SECTION

Capnia Pictet

Capnia Pictet 1841: 320. Claassen 1924: 43, 1931: 109, 1940: 91. Needham and Claassen 1925: 253. Hanson 1943b: 158, 1946: 229. Jewett 1956: 169, 1959: 42, 1960: 143. Illies 1966: 130. Zwick 1973: 370. Ricker and Scudder 1975: 338. Baumann, Gaufin, and Surdick 1977: 61. Harper and Stewart, 1984: 227. Stark, Szczytko, and Baumann 1986: 385. *Arsapnia* Banks 1897: 22, 1907a: 15. Claassen 1924: 43.

DIAGNOSIS.—Winged forms of *Capnia* may be separated from those of *Eucapnopsis*, *Iso-capnia*, *Nemocapnia*, and *Paracapnia* by R_1 of the wing curving anteriorly at the origin and recurving posteriorly to produce a curve near its origin. R_1 is flat in the latter three genera, not curving anteriorly near its origin. Males of *Capnia* are separated from those of *Bolshecapnia* by the absence of a sternal vesicle on sternum 9 and from *Utacapnia* by the lack of a laterally forked upper limb or limb remnant on the epiproct. *Allocapnia* males have an epiproct consisting of two limbs while *Capnia* males generally have a single-limbed epiproct (exceptions are *C. nearctica* and *C. valhalla*, which have a longer portion at the tip of the lower limb forming a curve, and *C. spinulosa*, which has the two limbs closely appressed). Males of *Mesocapnia* are morphologically distinct from *Capnia* in having a sharp, pointed spine at the apex of the epiproct; specimens of *Mesocapnia* may be identified using Baumann and Gaufin (1970). The presence of a lower limb of the epiproct, which is not appressed to the upper limb, serves to separate the males

of *Capnura* from those of *Capnia*. This lower limb in *Capnura* may be strongly reduced such as in *C. wanica*, half as long as the upper limb as in *C. elevata*, or fully as long as the upper limb as in *C. manitoba*. Any vestige of a lower limb is absent in most *Capnia*, although a long lower limb appressed to the upper limb is present in *C. nearctica*, *C. spinulosa*, and *C. valhalla*. These three species are currently left in *Capnia* even though they show phylogenetic affinities diverging from the rest of the genus. A detailed study comparing the remainder of the North American species to these three should provide valuable information regarding the phylogenetics of *Capnia* and other capniid genera. Generic placement of these three species awaits a revision of the genera of the world since they bear closer affinities to other species in the Palearctic, including *Capnia nigra*, than to other North American members of the genus.

Females of *Utacapnia* may be separated from those of *Capnia* by the presence of a darkened projection on the posterior margin of the subgenital plate. This projection is often split into two or more short lobes. The females of *Bolshecapnia*, *Mesocapnia*, and *Capnia* are difficult to separate by any simple characterization, but in general the subgenital plate of *Capnia* is more heavily sclerotized and darkened, especially near the posterior margin. Most females of *Mesocapnia* have a subgenital plate that narrows to a point on the posterior margin. This narrowed area of the plate in *Mesocapnia* is concolorous with the remainder of the plate; species of *Capnia* that have a narrowed posterior margin of the subgenital plate also have a darkened color pattern on the plate (Fig. 220). The presence of a light medial area (often with an imbedded Y-shaped sclerite) on the subgenital plate of females of *Capnura* serves to distinguish females of this genus from *Capnia*.

DISTRIBUTION.—In North America species in this genus inhabit streams from the Atlantic coast of Quebec to the shores of the Pacific in Alaska (Fig. 280). They are distributed from the north slope of the Brooks Range in Alaska and streams draining into Ungava Bay in northern Quebec to the isolated mountain islands of southern Arizona, California, and northwestern Mexico. They are absent from most of the Great Plains east of the Rocky Mountains in the United States but occur fur-

ther east on the prairies of Manitoba and Saskatchewan in Canada.

The largest number of species inhabit the streams of the Cascade Mountains, Sierra Nevada, and Rocky Mountains. Two species, *C. vernalis* and *C. confusa*, are responsible for the broad distributional range of the genus; however, most species in the genus have a much narrower range, often limited to a single mountain mass within one of the larger mountain systems. Several species of *Capnia* have been described from very limited material from a single locality.

Capnia Species-Groups

The genus *Capnia* can be divided into 10 species-groups (Table 1), each supported by one or more synapomorphies (Nelson, unpublished data and summarized in the beginning of the individual species-group sections). The characters used to differentiate the groups in the following key are a subset of these synapomorphies. The following key will also aid in the identification of the several species of *Capnia* not placed in the various species-groups. A couplet separating the genus *Mesocapnia* is included for convenience; species in this group can be identified using Baumann and Gaufin (1970). An analysis of the phylogenetics of the genus, its groups, and their relationships to other genera in the family is underway and will be published at a future date. Preliminary results lead us to believe that the group concepts used in this publication will be the same as that of a more detailed phylogenetic analysis that is planned. It should be noted that the key to the males is more compact and concise (when compared to that of the females) because more unambiguous characters are available for the males than the females. No attempt is made to provide a key to the nymphs; current concepts used to differentiate capniid nymphs even at the generic level are most inadequate. Further comparative morphological studies of capniid nymphs is necessary to screen the variety of characters currently used to separate genera for taxonomic utility.

Key to Males of Species Groups
and Unassigned Species of *Capnia*

1. Epiproct composed of two appressed limbs
(Figs. 108, 164, 188) 2
- Epiproct composed of a single limb that is some-
times partially divided near apex 4

TABLE 1. Groups of *Capnia*

Barberi Group

- 1. *Capnia barberi* Claassen
- 2. *C. hornigi* Baumann & Sheldon
- 3. *C. mono* Nelson & Baumann
- 4. *C. palomar* Nelson & Baumann
- 5. *C. shepardi* Nelson & Baumann
- 6. *C. yosemite* Nelson & Baumann

Californica Group

- 7. *Capnia californica* Claassen
- 8. *C. jewetti* Frison
- 9. *C. ophiona* Nelson & Baumann
- 10. *C. quadrituberosa* Hitchcock
- 11. *C. regilla* Nelson & Baumann
- 12. *C. saratoga* Nelson & Baumann
- 13. *C. unipqua* Frison
- 14. *C. ventura* Nelson & Baumann

Coloradensis Group

- 15. *Capnia coloradensis* Claassen
- 16. *C. hitchcocki* Nelson & Baumann
- 17. *C. petila* Jewett

Decepta Group

- 18. *Capnia arapahoe* Nelson & Kondratieff
- 19. *C. coyote* Nelson & Baumann
- 20. *C. decepta* (Banks)
- 21. *C. pileata* Jewett
- 22. *C. sequoia* Nelson & Baumann
- 23. *C. teresa* Claassen
- 24. *C. tumida* Claassen
- 25. *C. utahensis* Gaufin & Jewett

Excavata Group

- 26. *Capnia cheama* Ricker
- 27. *C. excavata* Claassen
- 28. *C. uintahi* Gaufin

Gracilaria Group

- 29. *Capnia elongata* Claassen
- 30. *C. gracilaria* Claassen
- 31. *C. lacustra* Jewett
- 32. *C. promota* Frison

Mariposa Group

- 33. *Capnia giulianii* Nelson & Baumann
- 34. *C. inyo* Nelson & Baumann
- 35. *C. mariposa* Nelson & Baumann

Nana Group

- 36. *Capnia glabra* Claassen
- 37. *C. licina* Jewett
- 38. *C. melia* Frison
- 39. *C. nana* Claassen
- 40. *C. oregona* Frison
- 41. *C. willametta* Jewett

Nearctica Group

- 42. *Capnia nearctica* Banks
- 43. *C. valhalla* Nelson & Baumann

Vernalis Group

- 44. *Capnia confusa* Claassen
- 45. *C. lineata* Hanson
- 46. *C. vernalis* Newport

Species of uncertain group status

- 47. *Capnia scobina* Jewett
- 48. *C. sextuberculata* Jewett
- 49. *C. spinulosa* Claassen
- 50. *C. zuckli* Hanson

Species of uncertain taxonomic status

- 51. *Capnia erecta* Jewett

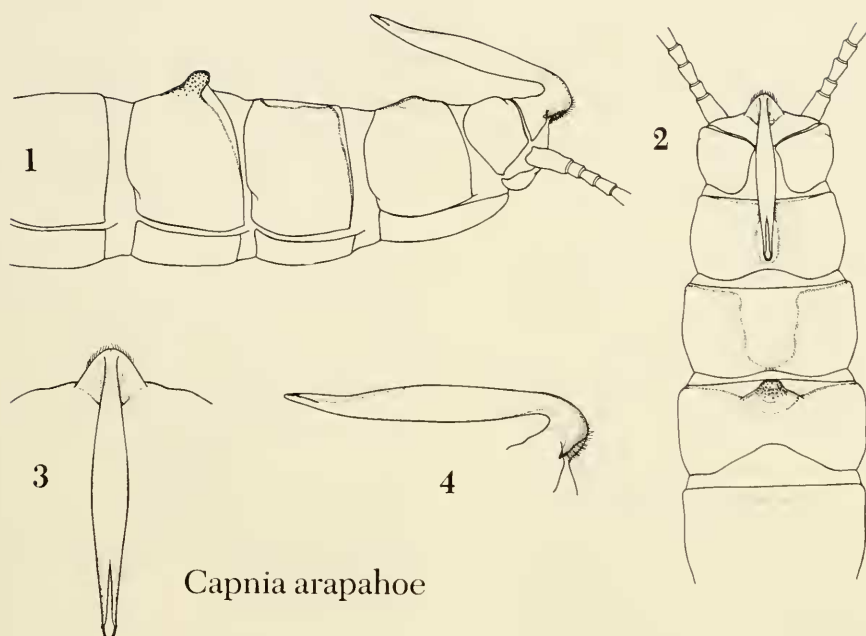
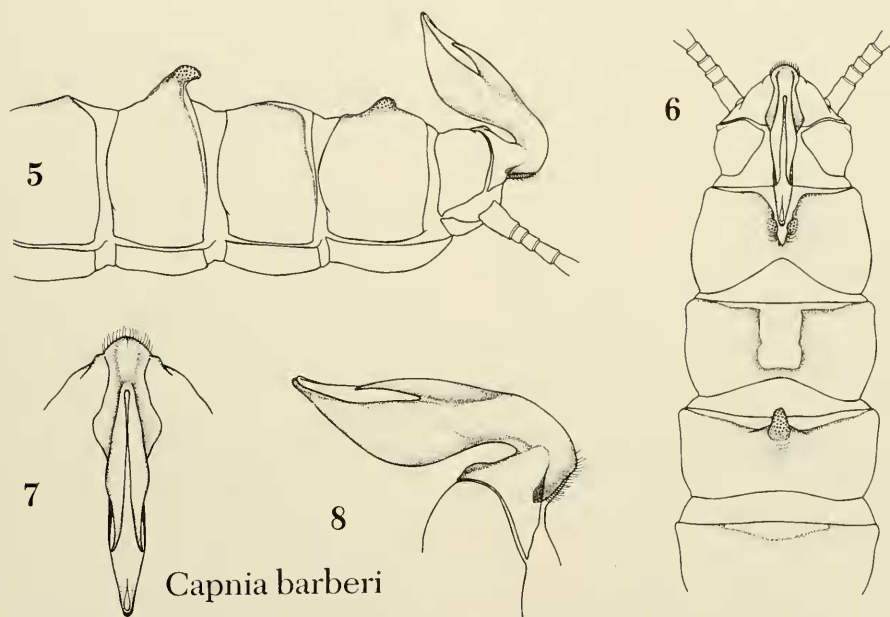
- 2(1). Epiproct with both limbs tightly appressed along entire length, lower limb not curving away from upper apically (Fig. 164) *spinulosa* Claassen
- Epiproct with lower limb separated from upper near apex, tip of lower limb curving upward then downward ... Nearctica Group (page 336) 3
- 3(2). Base of epiproct strongly constricted (Fig. 187), arched portion of lower limb about half as long as epiproct (Fig. 188) *valhalla* Nelson & Baumann
- Base of epiproct broadly joined to abdomen (Fig. 107), arched portion of lower limb about one-third length of epiproct (Fig. 108) *nearctica* Banks
- 4(1). Male abdominal terga bearing paired hooked knobs on segments 6–8 (Figs. 153, 154) *sextuberculata* Jewett
- Male terga with fewer knobs (may be absent), never on all three listed segments (Figs. 14, 26, 66, 70) 5
- 5(4). Paired tergal knobs present on segments 8 or 9 or both (Figs. 14, 66, 190) or on segments 5 and 6 (*C. jewetti*, Fig. 70) 6
- Paired tergal knobs absent from segments 5, 6, and 8, 9 (Figs. 26, 194), although a single medial knob may be present on one or more of these segments; or if paired knobs present on 9, tergum 7 also bearing knob (Figs. 5, 117) 7
- 6(5). Epiproct with antepical dorsomedial membranous area (Figs. 11, 15, 71, 111, 135, 139, 143, 179, 191); epiproct bulbous, consisting of two processes in lateral view (Fig. 192); lateral horns of epiproct absent ... Californica Group (page 302)
- Epiproct with membranous area apical (Figs. 47, 67, 87); epiproct not bulbous, consisting of a single lobe; short lateral horns of epiproct usually present (absent in *C. inyo*) Mariposa Group (page 328)
- 7(5). Tergum 7 or tergum 8 bearing medial knob of various sizes (Figs. 5, 21, 33, 97; small in *C. hitchcocki*, Fig. 57) 8
- Terga 7 and 8 lacking medial knob 13
- 8(7). Epiproct tip hanging downward (Figs. 24, 60, 124) Coloradensis Group (page 308)
- Epiproct tip horizontal or curving upward (Figs. 28, 52, 56) 9
- 9(8). Tergum 8 with highly modified knob bearing setae (Figs. 18, 42, 102) 10

- Tergum 8 without medial knob 11
- 10(9). Epiproct with broad lateral flange; knob on tergum 8 forming cowl that covers tip of epiproct to lateral flange in unrelaxed specimens (Figs. 19, 43, 175) Excavata Group (page 320)
- Epiproct without lateral flange, only slightly expanded laterally (Figs. 99, 199); knob on tergum 8 less prominent Nana Group (page 330)
- 11(9). Epiproct long and tubelike, not highly gibbous in lateral view (Figs. 40, 56, 76, 132); knob on tergum 7 often low, only slightly modified with few sensillae (well developed in *C. elongata*, absent in *C. lacustra*); horns absent from apex of epiproct Gracilaria Group (page 322)
- Epiproct shorter, bulbous in either lateral or dorsal views or both (Figs. 8, 35, 36); knob on tergum 7 well developed (less so in *C. utahensis*); lateral horns present on tip of epiproct 12
- 12(11). Tergum 9 divided and bearing prominent sensillae; epiproct not greatly broadened laterally (Figs. 7, 63, 95, 119, 159, 203); horns not on extreme apex of epiproct, but located near gibbosity Barberi Group (page 296)
- Tergum 9 divided but not modified to bear sensillae; epiproct greatly broadened laterally (Figs. 31, 35, 127, 151, 176, 171, 183; narrow in *C. arapahoe*, Fig. 3); horns short and appressed to extreme apex of epiproct Decepta Group (page 310)
- 13(7). Epiproct directed posteriorly, not recurved over abdomen (may be a malformed specimen, known only from holotype) *erecta* Jewett
- Epiproct recurved over abdomen in usual fashion 14
- 14(13). Epiproct with tip modified into a sharp spine *Mesocapnia* Rauser
- Epiproct with tip blunt 15
- 15(14). Epiproct bending to the left in dorsal view (Fig. 147) and armed with short, heavy spines *scobina* Jewett
- Epiproct oriented on midline of abdomen in dorsal view, lacking spination on shaft 16
- 16(15). Epiproct bending sharply near base in lateral view (Fig. 76); adults known only from deep in Lake Tahoe *lacustra* Jewett
- Epiproct curving evenly near base; adults caught near large rivers, small streams, and lake margins 17
- 17(16). Epiproct more than 15 times as long as high in lateral view (Fig. 208); wings of male short *zukei* Hanson
- Epiproct less than 15 times as long as high in lateral view (Figs. 28, 84, 196); wings of male short or long Vernalis Group (page 338)
- tized, contrasting with remainder of sternum 8 (Figs. 211, 215, 218) 2
- Subgenital plate lighter (Figs. 222, 229, 256), if dark then darkness diffuse, coming from internal structures (Fig. 234) 14
- 2(1). Dark area of plate wide, 0.4–0.8 width of sternum 8; dark area usually as wide as long (Figs. 230, 232) 3
- Dark area of plate narrower 0.2–0.35 width of sternum 8; dark area longer than wide (Figs. 215, 248, 250) 8
- 3(2). Hind margin of plate with medial area either produced (Fig. 220) or notched (Fig. 249) posteriorly 4
- Hind margin of plate entire, medial posterior margin area not produced or notched but broadly rounded 5
- 4(3). Medial area of plate produced posteriorly as an angular extension, not notched (Fig. 220) *excavata*
- Medial area of posterior margin of plate notched broadly, not produced posteriorly (Fig. 249) *teresa*
- 5(3). Sterna 7 and 8 broadly joined by sclerotized bridge yielding continuous sclerite (Fig. 219) *elongata*
- Sterna 7 and 8 separated by membrane, if joined then anterior part of sternum 7 membranous or at least color contrasting greatly with posterior part and sternum 8 (Figs. 211, 230, 254) 6
- 6(5). Darkest area of subgenital plate triangular (Fig. 254) *valhalla*
- Darkest area of subgenital plate quadrate (Figs. 211, 230) 7
- 7(6). Internal sclerotization of vagina visible through subgenital plate, forming a rough trapezoid Coloradensis Group (page 308)
- Internal sclerotization of vagina obscured by very dark subgenital plate Barberi and Mariposa Groups (pages 296, 328)
- 8(2). Medial dark area of plate narrow, width 0.2 (or less) of segment 8, posterior margin angularly produced rearward (Fig. 248) 9
- Medial dark area of plate wider, 0.25–0.35 width of segment 8, posterior margin entire, not greatly produced rearward in angular flap 11
- 9(8). Posterior margin of subgenital plate evenly rounded, not extending medially with an angulate or notched projection (Fig. 254) *valhalla*
- Posterior margin of subgenital plate extending medially with an angulate or notched projection (Figs. 235, 248) 10
- 10(9). Medial dark area of subgenital plate notched posteriorly, dark color not extending anteriorly to margin of sternum 8 (Fig. 235) *nearctica*
- Medial dark area of subgenital plate not notched posteriorly, dark color extending anteriorly to margin of sternum 8 as a narrow band (Fig. 248) *spinulosa*

Key to the Females of *Capnia*

(*arapahoe*, *erecta*, *gudlanii*, *ophiona*, and *willametta* unknown)

1. Subgenital plate externally dark, heavily sclero-

*Capnia arapahoe**Capnia barberi*

Figs. 1–4. *Capnia arapahoe* Nelson & Kondratieff: 1, male terminalia, lateral; 2, male terminalia, dorsal; 3, male epiproct, dorsal; 4, male epiproct, lateral. Colorado, Larimer Co., Young Gulch above Ansel Watrous Campground, 22 March 1986, B. C. Kondratieff.

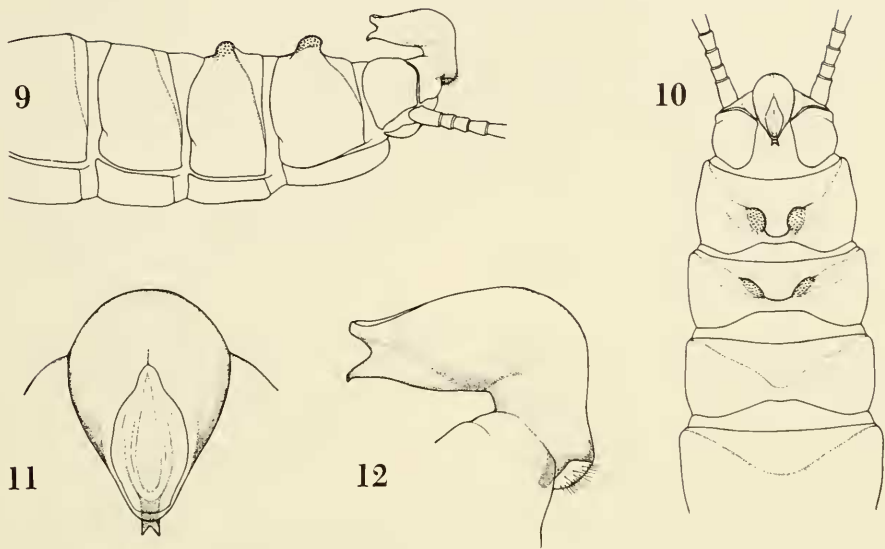
Figs. 5–8. *Capnia barberi* Claassen: 5, male terminalia, lateral; 6, male terminalia, dorsal; 7, male epiproct, dorsal; 8, male epiproct, lateral. California, Plumas Co., Long Valley Creek, Hwy 70, Cromberg, 14 February 1985, R. W. Baumann and C. R. Nelson.

- 11(8). Internal sclerotization visible through plate; plate with origins in membrane between sterna 7 and 8, notched laterally in basal one-fourth (Figs. 215, 238) *Coloradensis* Group (except *hitchcocki*) (page 308)
- Internal sclerotization not visible through plate; plate originating as anterior margin of sternum 8; notches, if present, usually in distal three-fourths (Note: some specimens of *decepta* are laterally notched in basal one-fourth, but the plate is usually broader than that of *coloradensis*.) 12
- 12(11). Subgenital plate light, not heavily sclerotized, deeply notched on lateral margins to produce hourglass shape (Fig. 246) *sextuberculata*
- Subgenital plate darker, heavily sclerotized, lateral notches not so deep (Figs. 214, 218) 13
- 13(12). Posterior margin of plate notched medially, producing pair of sclerotized projections (Fig. 214) *cheama*
- Posterior margin of plate entire (Fig. 218) *Decepta* Group (except *teresa*, which is notched) (page 310)
- 14(1). Sterna 7 and 8 joined in sclerotized bridge (Fig. 256), or with medial projection on hind margin of sternum 8 (Fig. 216), or with irregular sclerites imbedded near midline between these segments (Fig. 229); hind margin of plate recessed and bearing paired internal sclerotized patches (patches absent in *confusa*, Fig. 216) *Vernalis* Group (page 338)
- Sterna 7 and 8 separated, or if joined (*petila*, Fig. 238) then hind margin of plate without heavy internal sclerotization 15
- 15(14). Hind margin of plate notched medially 16
- Hind margin of plate entire or with medial posterior projection 18
- 16(15). Hind margin of plate straight except for medial notch (Fig. 249) *teresa*
- Hind margin of plate angular, continuing evenly from lateral margins with medial apical notch 17
- 17(16). Angular projection on hind margin of plate broad, with wide, deep notch (Fig. 214) *cheama*
- Angular projection narrow, notch narrow and shallow (Fig. 235) *nearctica*
- 18(15). Hind margin of plate a dark, well-defined, even line (Fig. 221) *glabra*
- Hind margin of plate variable, darkness, if present, not even and well defined 19
- 19(18). Hind margin of plate with slight medial posterior projection, often with additional irregular projections (Figs. 219, 222, 227, 240); hind margin often darkened .. *Gracilaria* Group (page 322)
- Hind margin of plate without projections 20
- 20(19). Hind margin of plate a heavily sclerotized bar that is uncolored, some species with medial angular flap overhanging this light-colored bar (Figs. 212, 213, 226, 241, 243, 252, 255) *Californica* Group (page 302)
- Hind margin of plate either lightly sclerotized and lightly colored or heavily sclerotized and heavily colored, not heavily sclerotized and lightly colored 21
- 21(20). Hind margin of plate with internal darkening that becomes lighter moving anteriorly and medially, resulting in a dark triangle with a lighter apex directed anteriorly (Figs. 221, 228, 231, 233, 234, 236, 254) *Nana* Group (page 330) and *valhalla*
- Hind margin of plate not darkened, about same color as anterior margin 22
- 22(21). Darkening of subgenital plate resembling hourglass (Fig. 246) *sextuberculata*
- Darkening of subgenital plate not resembling hourglass 23
- 23(22). Sterna 7 and 8 joined medially; hind margin of plate with slight medial projection (Fig. 238) .. *petila*
- Sterna 7 and 8 separate; hind margin of plate straight, recessed anteriorly from hind margin of lateral sclerites of segment 8 24
- 24(23). Length 9 mm; inhabiting streams on west central border of Idaho (Latah Co.); subgenital plate as in Fig. 258 *zukei*
- Length 6–7 mm; not in streams of western Idaho 25
- 25(24). Inhabiting streams of Lake Tahoe area in east central California *scobina*
- Inhabiting streams of central Rocky Mountains and mountains of eastern Great Basin *uintahi*

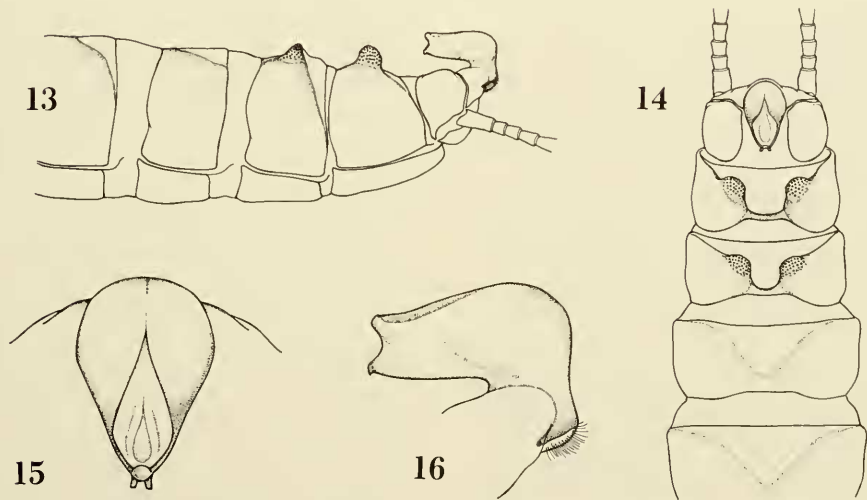
Barberi Group

This group is unified by the presence of a tergal knob on segment 7, a pair of tergal knobs on segment 9, the presence of rather short lateral horns located some distance from the apex of the epiproct, and an extensive membranous portion of the epiproct dorsally that extends over one-half the length of the epiproct. The females in the group have a broad, heavily colored and sclerotized subgenital plate that often bulges ventrally. Some of the species of the group have females that have the subgenital plate joined by a broad band of sclerotization to sternum 8. The species included in this group are *C. barberi* Claassen, *C. hornigi* Baumann & Sheldon, *C. mono* Nelson & Baumann, *C. palomar* Nelson & Baumann, *C. shepardi* Nelson & Baumann, and *C. yosemite* Nelson & Baumann.

DISTRIBUTION.—Members of this group are confined to the Sierra Nevada and adjacent mountain ranges from the Mount Lassen area on the north to Palomar Mountain in San Diego County on the south. The White Mountains of western Nevada are home to at



Capnia californica



Capnia californica

Figs. 9–12. *Capnia californica* Claassen: 9, male terminalia, lateral; 10, male terminalia, dorsal; 11, male epiproct, dorsal; 12, male epiproct, lateral. California, Marin Co., Bear Valley Creek, Point Reyes National Seashore, 25 May 1975, D. C. Denning.

Figs. 13–16. *Capnia californica* Claassen: 13, male terminalia, lateral; 14, male terminalia, dorsal; 15, male epiproct, dorsal; 16, male epiproct, lateral. Arizona, Gila Co., Strawberry Creek, Hwy 87, Strawberry, 14 January 1984, R. W. Baumann and C. R. Nelson.

least one of the species of this group (*C. hornigi*). The individual species of this group generally have quite narrow ranges, and further collecting in the future would be desirable to identify the actual limits of the ranges of the species. It is not uncommon to find several of the species in this group occurring sympatrically and synchronously.

Key to the Males of the Barberi Group

1.

Lobular free portion of tergal knob on segment 7 broad, greater than one-fourth width of segment (Figs. 94, 158)

2
- Lobular free portion of tergal knob on segment 7 narrow, less than one-tenth width of segment (Figs. 6, 62, 118, 202)

3
- 2(1).

Apex of epiproct truncate; membranous portion of epiproct darkened (Figs. 158, 159)

shepardi Nelson & Baumann
- Apex of epiproct pointed; membranous portion of epiproct light (Figs. 94, 95)

mono Nelson & Baumann
- 3(1).

Epiproct three times as long as high (Fig. 8), horn-bearing ridges of epiproct parallel (Fig. 7)

barberi Claassen
- Epiproct more than three times as long as high, horn-bearing ridges diverging apically (Figs. 64, 119, 204)

4
- 4(3).

Epiproct deeply recurved, horn separated from gibbosity by a curving notch in lateral view (Fig. 204); apex of tergal knob on segment 7 deeply bifid (Fig. 202)

yosemite Nelson & Baumann
- Epiproct not curving so deeply, horn joining gibbosity at an acute angle; apex of tergal knob unsplit or shallowly split (Figs. 64, 120)

5
- 5(4).

Horn longer, one-fifth length of epiproct in lateral view (Fig. 61); tergal knob on segment 7 strongly lobular, tubercles generally limited to knob (Fig. 62); dorsal membranous area of epiproct broad, extending basally one-half length of epiproct (Fig. 63)

hornigi Baumann & Sheldon
- Horn shorter, one-ninth length of epiproct in lateral view (Fig. 120); tergal knob on segment 7 not as strongly produced, tubercles more diffuse, covering broad area (Fig. 118); dorsal membranous area in large part limited to tip extending basally in a narrow furrow (Fig. 119)

palomar Nelson & Baumann

Key to the Females of the Barberi Group

1.

Subgenital plate parallel sided, not becoming narrower distally (Figs. 211, 232, 237)

2
- Subgenital plate with lateral margins converging distally (Figs. 224, 247, 257)

4
- 2(1).

Subgenital plate joined broadly to sternum 7 (as in Fig. 219)

southern *barberi*
- Subgenital plate separated from sternum 7 by a band of membrane or joined to sternum 7 in a narrow, medial bridge (Figs. 232, 237)

3

- 3(2).

Subgenital plate separated from sternum 7 by a membranous band (Figs. 232, 211)

mono, northern *barberi*
- Subgenital plate joined to sternum 7 by a narrow, medial bridge (Fig. 237)

palomar
- 4(1).

Subgenital plate bulging ventrally forming a hemisphere when viewed laterally

yosemite
- Subgenital plate may be bulging but not forming a complete hemisphere

5
- 5(4).

Subgenital plate with apparent notches laterally at junction of sternites 7 and 8 (Fig. 247)

shepardi
- Subgenital plate without lateral notches at junction of sternites 7 and 8 (Fig. 224)

hornigi

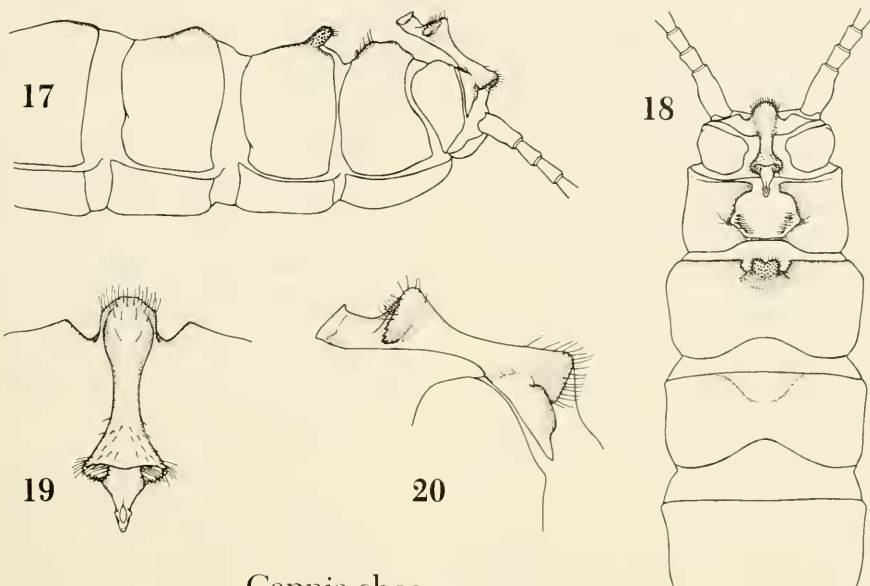
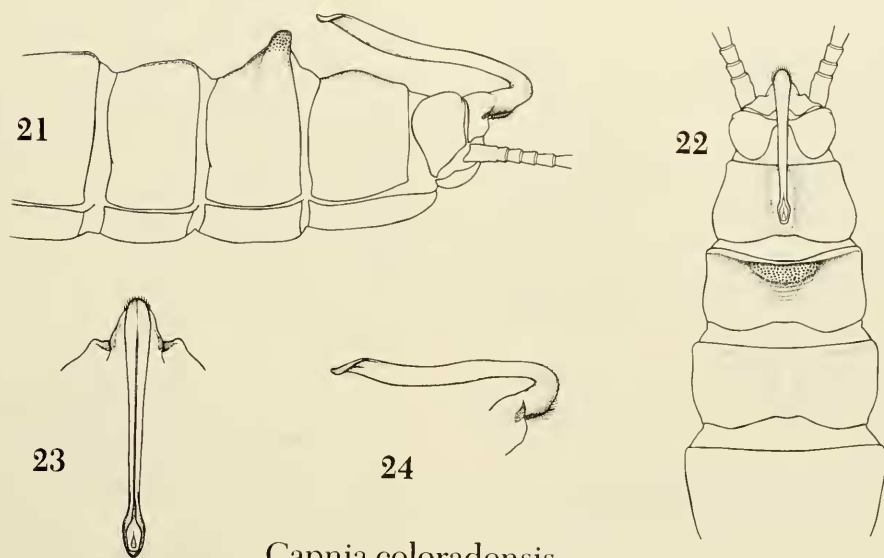
Capnia barberi Claassen
Figs. 5–8, 211, map Fig. 259

Capnia barberi Claassen 1924: 55, 1940: 92. Needham and Claassen 1925: 267. Hanson 1946: 238. Jewett 1956: 169, 1960: 143. Illies 1966: 132. Nebeker and Ganfin 1967a: 418. Sheldon and Jewett 1967: 4. Zwick 1973: 371. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Plumas Co., Feather River Canyon near Caribou, 24 January 1923, H. S. Barber; (USNM).

DIAGNOSIS.—The male of this species is differentiated from others in the group by the parallel orientation of the horn-bearing sclerites of the epiproct as seen from dorsal view coupled with the horns distant from the apex. The long, narrow horns that are separated from the main body of the epiproct at an acute angle help in segregation of this species from *C. yosemite*, in which the horn connects to the body in a deep, broad notch, and the remaining species in the group which have shorter horns. The females of this species are not readily separated from others in the group. The females occur in two forms, those with a square subgenital plate that originates with the anterior margin of sternum 8 and those with a rectangular plate with origins in the distal third of sternum 7. The square-plated female occurs in all the reported localities except those in the southernmost extensions of the range of the species, such as localities in Tuolumne County. The following description of the female of this species is based on material from the northern portion of its range, near the type locality of the male.

DESCRIPTION.—Female, wing macropterous; forewing 7.2 mm in length; length of body 5.8 mm. Subgenital plate square but with posterior margin irregular, plate heavily sclerotized and darkened, originating at anterior margin of sternum 8; sterna 7 and 8 separated by a distinct intersegmental membrane;

*Capnia cheama**Capnia coloradensis*

Figs. 17–20. *Capnia cheama* Ricker: 17, male terminalia, lateral; 18, male terminalia, dorsal; 19, male epiproct, dorsal; 20, male epiproct, lateral. Montana, Lincoln Co., Kootenai River, 19 March 1970, R. L. Newell.

Figs. 21–24. *Capnia coloradensis* Claassen: 21, male terminalia, lateral; 22, male terminalia, dorsal; 23, male epiproct, dorsal; 24, male epiproct, lateral. Colorado, Routt Co., Willow Creek near Halns Peak, 13 May 1968, B. R. Oblad.

posterior margin of sternum 7 lightly sclerotized, anterior portion of segment more or less membranous.

MATERIAL.—Female, California, Plumas Co., Long Valley Creek, Highway 70, Cromberg, 14 February 1985, R. W. Baumann and C. R. Nelson; (BYU).

DISTRIBUTION.—CALIFORNIA: Alpine Co.; El Dorado Co.; Nevada Co.; Placer Co.; Plumas Co.; Shasta Co.; Sierra Co.; Tehama Co.; Tuolumne Co. NEVADA: Washoe Co.; (1440). 9 December–24 June.

Capnia hornigi Baumann & Sheldon

Figs. 61–64, 224, map Fig. 260

Capnia hornigi Baumann & Sheldon 1984: 30. Stark et al. 1986: 385.

HOLOTYPE.—Male, #76499 (and female allotype), Nevada, Esmeralda Co., White Mountains, Middle Creek, 10 February 1977, A. L. Sheldon; (USNM).

DIAGNOSIS.—Males of this species are distinguished from those of *C. mono* and *C. shepardi* by having a narrow tergal knob on segment 7 that is unsplit or slightly split at the tip. The males of *C. hornigi* are separated from those of *C. barberi* by the more slender epiproct (Fig. 64) and from *C. yosemite* by the appressed horns and the epiproct not being compoundly curved as in *C. yosemite*. The females of this species are not readily separated from others in the group but are a member of the subgroup that has the heavily sclerotized portion of the subgenital plate originating on the distal third of sternum 7. The lateral margins of the female plate converge distally, a character they share with the females of *C. yosemite*.

DISTRIBUTION.—CALIFORNIA: Mono Co.; NEVADA: Esmeralda Co.; (58). 10 February–4 March.

Capnia mono Nelson & Baumann

Figs. 93–96, 232, map Fig. 260

Capnia mono Nelson & Baumann 1987c: 493.

HOLOTYPE.—Male (and female allotype), California, Mono Co., 2 miles north of Topaz, Slinkard Creek, 5 November 1983, William D. Shepard, reared from nymphs; (USNM).

DIAGNOSIS.—This species is identified by the large, divided tergal knob on segment 7. The other member of the group having a broad knob is *C. shepardi*, from which this species may be distinguished by the deep epiproct borne on a thick neck. The neck of

C. shepardi is thinner and is recognized as compoundly curved. Additionally, the membranous portion of the epiproct of *C. shepardi* is darkly colored especially near the truncate apex. The membrane of *C. mono* is uniformly white with the apex forming a sharper point than that of *C. shepardi*.

The female has a square subgenital plate similar to and indistinguishable from that of the northern females of *C. barberi*. These two forms may be separated from all other females in the group except *C. palomar* by the shorter plate, which begins on sternum 8 and is separated from sternum 7 by a narrow band of membrane. The female of *C. palomar* has a narrow bridge joining sterna 7 and 8.

DISTRIBUTION.—CALIFORNIA: Mono Co.; (28). 5 November–5 April.

Capnia palomar Nelson & Baumann

Figs. 117–120, 237, map Fig. 259

Capnia palomar Nelson & Baumann 1987c: 498.

HOLOTYPE.—Male (and female allotype), California, San Diego Co., Palomar Mountain, Fry Creek Campground, Fry Creek, Road S–6, 18 January 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—This species is distinguished by the horns nearly reaching the apex of the epiproct. No other species in the group has the horns so near the tip. It is also separated from the similar species, *C. hornigi*, by the narrower dorsal membranous area on the epiproct. It can be diagnosed from *C. shepardi* by the less-developed, compound curve of the epiproct (Fig. 120) and the more pointed apex in dorsal view.

DISTRIBUTION.—CALIFORNIA: Riverside Co.; San Diego Co.; (13). 18–19 January.

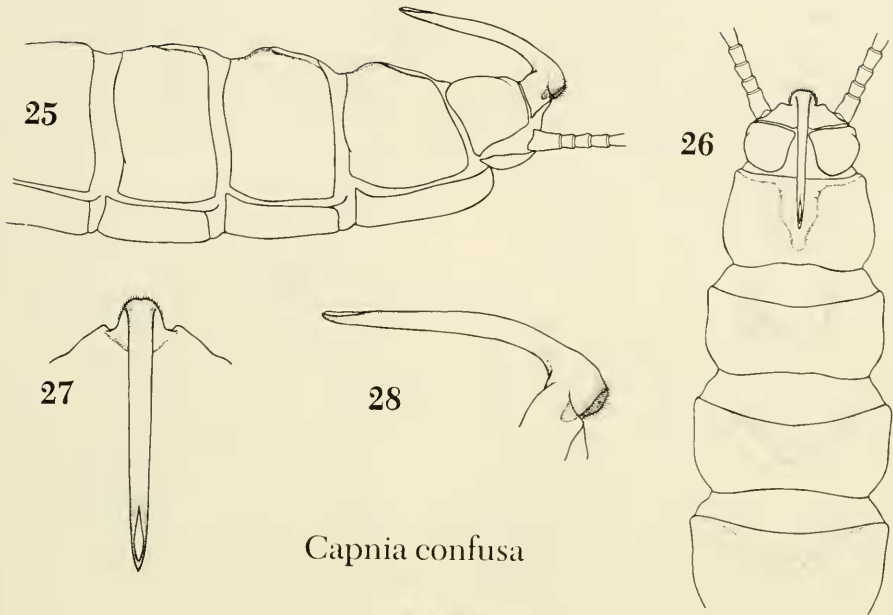
Capnia shepardi Nelson & Baumann

Figs. 157–160, 247, map Fig. 260

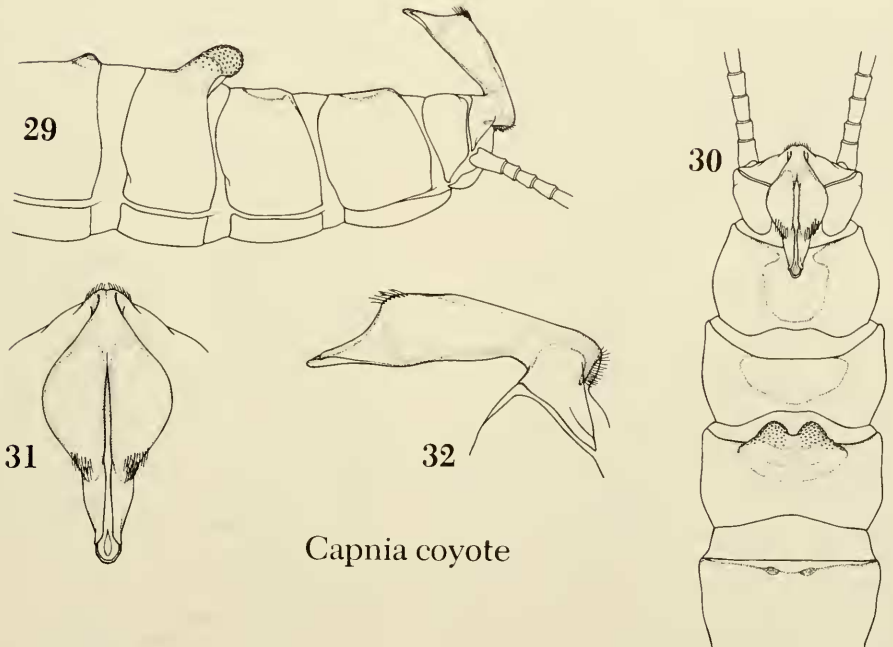
Capnia shepardi Nelson & Baumann 1987c: 495.

HOLOTYPE.—Male (and female allotype), California, Mono Co., Lee Vining Creek at Lee Vining Campground, 14 March 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—This species may be separated from other forms by the broad tergal knob on segment 7 and a compoundly curving epiproct. *Capnia mono* has a broad knob on tergum 7, but the epiproct does not curve compoundly. This species is the only member of the group with a truncate epiproctal tip and also the only member of the group with the



Capnia confusa



Capnia coyote

Figs. 25–28. *Capnia confusa* Claassen: 25, male terminalia, lateral; 26, male terminalia, dorsal; 27, male epiproct, dorsal; 28, male epiproct, lateral. Montana, Lincoln Co., Kootenai River, 28 March 1970, R. L. Newell.

Figs. 29–32. *Capnia coyote* Nelson & Baumann: 29, male terminalia, lateral; 30, male terminalia, dorsal; 31, male epiproct, dorsal; 32, male epiproct, lateral. California, Los Angeles Co., San Gabriel Mountains, Little Rock Creek, Cooper Canyon Campground, 31 March 1981, R. W. Baumann and J. A. Stanger.

membrane of the epiproct darkened. The females have distinctive notches in the subgenital plates marking the division of sterna 7 and 8. In *C. palomar* these notches are deeper, nearly dividing the segments.

DISTRIBUTION.—CALIFORNIA: Inyo Co.; Mariposa Co.; Mono Co.; Nevada Co.; Placer Co.; (73). 21 February–21 April.

Capnia yosemite Nelson & Baumann

Figs. 201–204, 257, map Fig. 259

Capnia yosemite Nelson & Baumann 1987c: 491.

HOLOTYPE.—Male (and female allotype), California, Mariposa Co., Big Creek, Highway 41, Summerdale Campground above Fish Camp, 18 March 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—The narrow, split knob on tergum 7, the extremely recurved epiproct, and the deep, broad area enclosed by the junction of the horns and the remainder of the epiproct differentiate this species from related forms. The female may be separated from others in the group by the strongly bulging subgenital plate (lateral view) that resembles a hemisphere. No other females have a subgenital plate that bulges to this extent. The lateral margins of the rectangular plate lack any notches such as those found in *C. shepardii* and *C. palomar*.

DISTRIBUTION.—CALIFORNIA: Mariposa Co.; Tuolumne Co.; (168). 18 March.

Californica Group

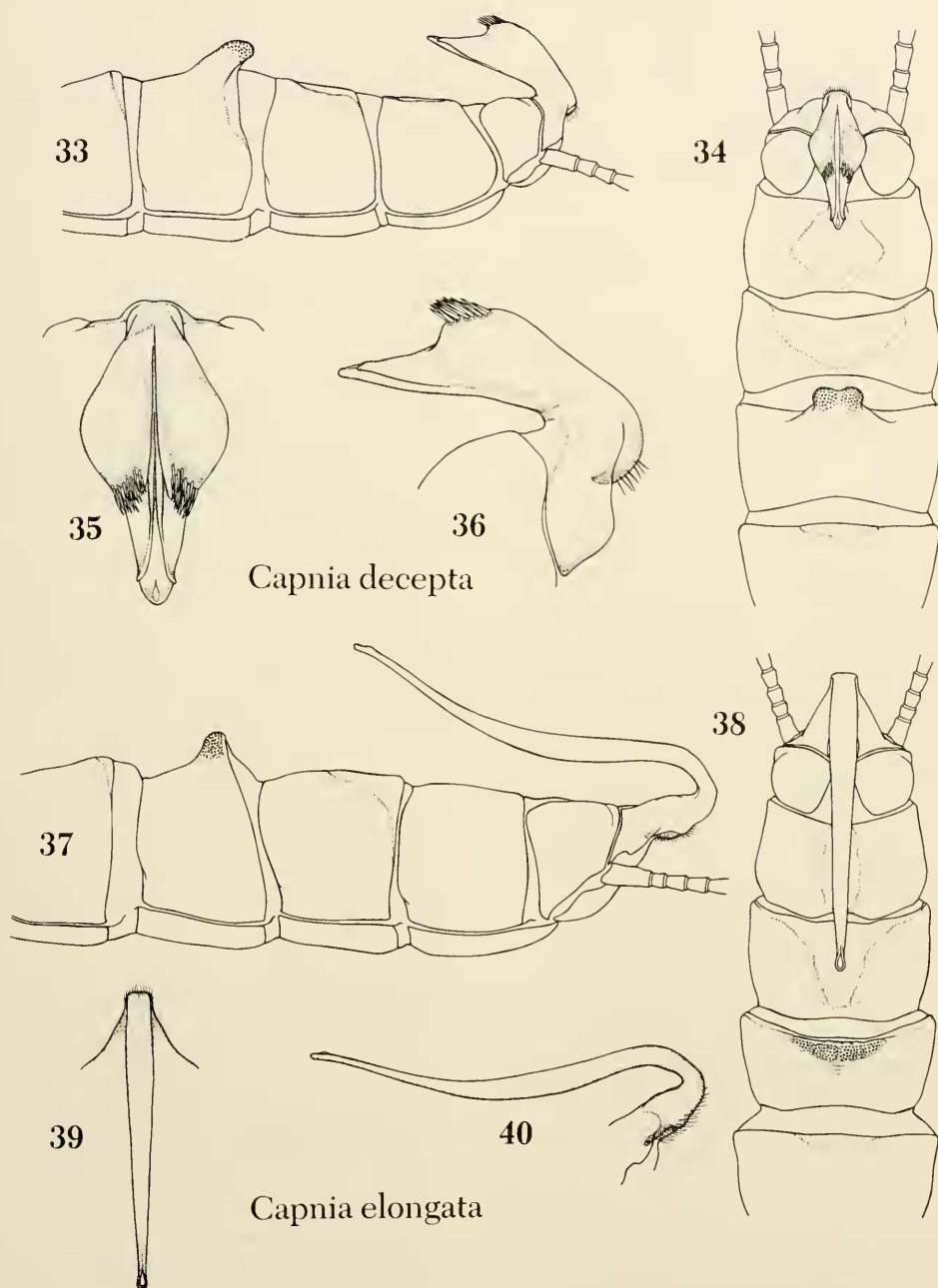
Members of the *Capnia californica* group include: *C. californica* Claassen, *C. jewetti* Frison, *C. ophiona* Nelson & Baumann, *C. quadrituberosa* Hitchcock, *C. regilla* Nelson & Baumann, *C. saratoga* Nelson & Baumann, *C. umpqua* Frison, and *C. ventura* Nelson & Baumann. Claassen (1924) described the male of *C. californica* from material collected in Cazadero (Sonoma Co.), California, by E. P. Van Duzee. A female collected from a small creek near Saratoga (Santa Clara Co.) was described by Jewett (1954a) as being that of *C. californica*. This female was collected with several males that are similar and closely related to *C. californica* but are morphologically distinct, which Nelson and Baumann (1987c) named *C. saratoga*. Several collections of *C. californica* containing series of males and females have been made in the Shasta-Trinity area of northern California. Two vials of speci-

mens collected by D. G. Denning at Point Reyes National Seashore, near the type locality of *C. californica*, contain male and female specimens of *C. regilla* along with a single male of *C. californica*. This is the only record of sympatry among members of the group. Frison (1942) described *C. jewetti* from material collected in Muddy Creek, near Corvallis, Oregon. This species is placed in this group on the basis of the antepical dorsal membranous area of the epiproct of the male and the sclerotized bar along the hind margin of the female subgenital plate (not emphasized in Frison's figure of the female), with the knobs on terga 5 and 6 interpreted as being autapomorphic. Frison (1942) also named and described *C. umpqua* and presented figures for both the male and the female. *Capnia quadrituberosa* was described from the male by Hitchcock (1958). Nelson and Baumann (1987c) also described *C. ophiona* and *C. ventura*.

The *californica* group is distinguished from other members of the genus by the following characters: male having an epiproct with an antepical dorsal membranous area and having paired protuberances (knobs) on either tergum 8, 9, or both (exception *C. jewetti*, which has the paired knobs on terga 5 and 6). Females have a light-colored but sclerotized hind margin on the subgenital plate.

The group can be divided into two subgroups based on female characters (presence or absence of angular process projecting posteriorly over hind margin of subgenital plate) or three subgroups based on configurations of the male epiproct, including one subgroup with a pair of tergal knobs present on both terga 8 and 9; a subgroup with a single pair of knobs on tergum 9; and a third subgroup with tergal knobs on segments 5 and 6. Females are inseparable to species in the absence of males; hypotheses based on distribution may be useful in identifying females caught in the absence of males.

DISTRIBUTION.—This group is unique in having several morphologically distinct species located in close geographical proximity to each other. One species (*C. californica*) has its range separated by long distances. The group ranges from the Portland, Oregon, area south to Ventura County, California, with a disjunct species ranging in central and southern Arizona and northern Mexico. Several subdivisions of this general range are



Figs. 33–36. *Capnia decepta* (Banks): 33, male terminalia, lateral; 34, male terminalia, dorsal; 35, male epiproct, dorsal; 36, male epiproct, lateral. Arizona, Coconino Co., Oak Creek at Cave Springs Crossing, 27 December 1983, M. W. Sanderson, A82–20.

Figs. 37–40. *Capnia elongata* Claassen: 37, male terminalia, lateral; 38, male terminalia, dorsal; 39, male epiproct, dorsal; 40, male epiproct, lateral. California, Placer Co., North Fork American River near Colfax, 21 February 1985, R. W. Baumann and C. R. Nelson.

supported by species clusters, suggesting the occurrence of barriers that have contributed to speciation events in isolated areas.

Key to the Males of the Californica Group

1. Pairs of knobs present on both terga 8 and 9 (Figs. 10, 14, 110, 134) 2
- Pair of knobs present on tergum 9 only (Figs. 138, 142, 178, 190; weak on tergum 9 of *jewetti* but additional pairs of knobs present on terga 5 and 6 of *jewetti*, Fig. 70) 4
- 2(1). Upper process of epiproct absent (Fig. 112); dorsal membranous area of epiproct nearly reaching tip in dorsal view (Fig. 111) *ophiona* Nelson & Baumann
- Upper process present; represented by a narrow or blunt projection near anterior margin of dorsal membranous area (Figs. 12, 16, 136) 3
- 3(2). Upper process blunt (Fig. 136); declivity between upper and lower processes vertical or convex *quadrutuberosa* Hitchcock
- Upper process narrow; declivity between upper and lower processes concave (Figs. 12, 16) *californica* Claassen
- 4(1). Upper process of epiproct present (Figs. 140, 144, 192) 5
- Upper process of epiproct absent (Figs. 72, 180) 7
- 5(4). Lower process of epiproct split at tip (Fig. 139); center of dorsal membranous area of epiproct nearer tip than midpoint between base of epiproct and tip of lower process; upper and lower processes of epiproct short *regilla* Nelson & Baumann
- Lower process of epiproct undivided at tip (Figs. 143, 191); dorsal membranous area of epiproct centered nearer midpoint between base and tip; lower process longer than upper ... 6
- 6(5). Upper process long; lower process longer, with lower surface forming a nearly straight line from base to near tip (Fig. 192) *ventura* Nelson & Baumann
- Upper process short, reduced to a small knob near anterior margin of membranous area; lower process shorter, lower surface curving upward on distal third (Fig. 144) *saratoga* Nelson & Baumann
- 7(4). Terga 5 and 6 each bearing paired knobs (Figs. 69, 70) *jewetti* Frison
- Terga 5 and 6 without paired knobs (Figs. 177, 178) *umpqua* Frison

Capnia californica Claassen

Figs. 9–16, 212–213, map Figs. 261, 273

Capnia californica Claassen 1924: 57, 1940: 92. Needham and Claassen 1925: 262. Hanson 1946: 238. Jewett 1954a: 175, 1956: 170, 1960: 144. Illies 1966: 134. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Sonoma Co., Cazadero, 14 April 1918, E. P. Van Duzee; (CAS).

DIAGNOSIS.—The paired knobs present on both terga 8 and 9 and the split lower process on the tip of the epiproct distinguish this species from five species in the group. It may be further separated from the remaining species in the group on the basis of the combination of the following characters: the male epiproct of this species has two distinct processes on the tip region that have a concave area between them. *Capnia quadrutuberosa* has a remnant of an upper process; however, the declivity below this remnant falls abruptly to the lower process without a hint of concavity. The upper process of the epiproct is absent in *C. ophiona*.

DISTRIBUTION.—ARIZONA: Cochise Co.; Gila Co.; Graham Co.; Pima Co.; Santa Cruz Co. CALIFORNIA: Lake Co.; Napa Co.; Plumas Co.; Shasta Co.; Sonoma Co.; Trinity Co. CHIHUAHUA: Sierra Madre Occidental; (63). 10 January–27 April.

Additional females of uncertain species, but members of this group, are: CALIFORNIA: Santa Clara Co., 3.5 road miles east of summit of Mt. Hamilton, I-26-1974, J. Powell; San Benito Co., 5 miles west of Paicines Lime Kiln Rd., III-24-66, R. D. Usinger.

Capnia jewetti Frison

Figs. 69–72, 226, map Fig. 263

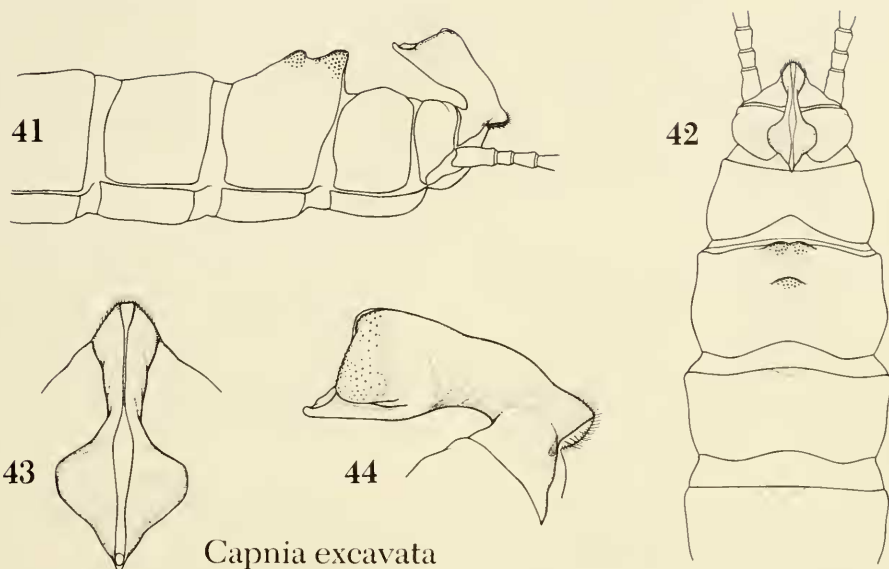
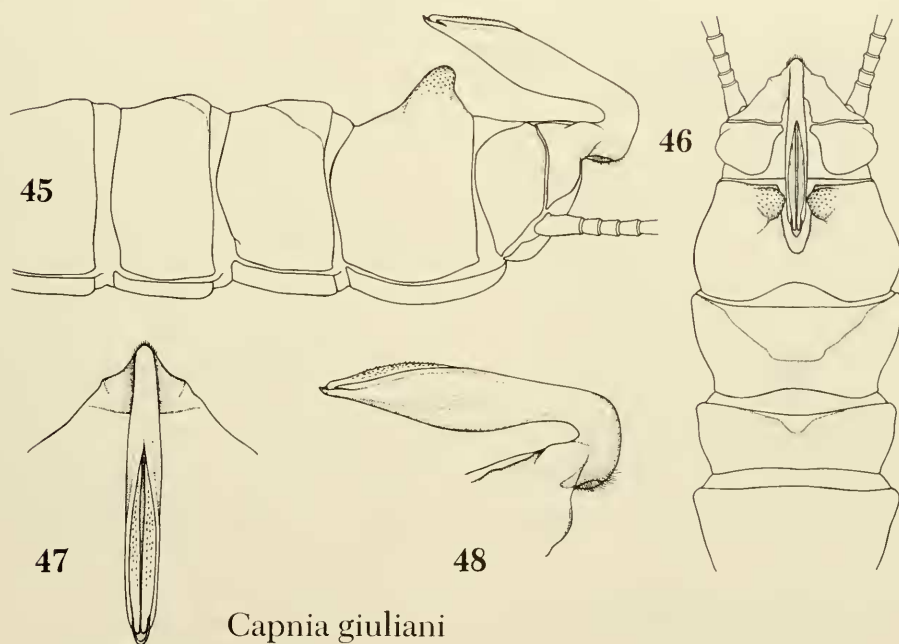
Capnia jewetti Frison 1942: 63. Hanson 1946: 239. Jewett 1959: 46. Illies 1966: 139. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Oregon, Benton Co., 14 miles south of Corvallis, Muddy Creek, 10 February 1938, S. G. Jewett, Jr.; (CAS).

DIAGNOSIS.—The male of this species is easily separated from other members of the group on the basis of the paired knobs present on terga 5 and 6 and the absence of tergal knobs on 8 and 9. Because of similarities of the shape of the epiproct and the placement of the dorsal membranous area on the epiproct, this species is most closely related to *C. umpqua*.

The female of *C. jewetti* is similar to that of *C. umpqua* and other members of the group in that it lacks a medial flap overhanging the sclerotized hind margin of the subgenital plate. Insufficient characters are available to distinguish females in the group as a whole, except to divide them into two complexes based on the subgenital flap.

DISTRIBUTION.—OREGON: Benton Co.; Clackamas Co.; Clatsop Co.; Columbia Co.;

*Capnia excavata**Capnia giuliani*

Figs. 41–44. *Capnia excavata* Claassen: 41, male terminalia, lateral; 42, male terminalia, dorsal; 43, male epiproct, dorsal; 44, male epiproct, lateral. California, Plumas Co., Mosquito Creek at junction North Fork Feather River, 14 February 1985, R. W. Baumann and C. R. Nelson.

Figs. 45–48. *Capnia giuliani* Nelson & Baumann: 45, male terminalia, lateral; 46, male terminalia, dorsal; 47, male epiproct, dorsal; 48, male epiproct, lateral. California, Inyo Co., Lone Pine Creek, Whitney Portal Campground, 3 April 1981, R. W. Baumann and J. A. Stanger.

Washington Co.; Yamhill Co. WASHINGTON: Clallam Co.; (42). 2 February–14 April.

Capnia ophiona Nelson & Baumann

Figs. 109–112, map Fig. 273

Capnia ophiona Nelson & Baumann 1987c: 506.

HOLOTYPE.—California, Butte Co., Butte Creek, Butte Meadows Campground, 15 February 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—This species is distinguished from both *C. californica* and the closely related *C. quadrituberosa* by the lack of an upper process on the epiproct and the absence of a sclerotized bridge separating the dorsal membranous area from the anterior margin of the epiproct. The female is unknown.

DISTRIBUTION.—CALIFORNIA: Butte Co.; (1). 15 February.

Capnia quadrituberosa Hitchcock

Figs. 133–136, 241, map Fig. 273

Capnia quadrituberosa Hitchcock 1958: 77. Jewett 1960: 146. Illies 1966: 146. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), California, Butte Co., small stream tributary to Feather River crossing Route 40A north of Oroville, 22 January 1955; (USNM).

DIAGNOSIS.—The male of this species most closely resembles that of *C. californica*. It may be separated from this species by its reduced upper process, the anterior margin of which drops perpendicularly until reaching the lower process which extends forward. It is also separated from *C. ophiona* by this perpendicular front margin on the epiproct; the epiproct of *C. ophiona* slopes directly from the dorsal membranous area to the lower process, the upper process being absent.

DISTRIBUTION.—CALIFORNIA: Butte Co.; Contra Costa Co.; El Dorado Co.; Nevada Co.; Placer Co.; Sacramento Co.; Tuolumne Co.; (204). 22 January–18 May.

Capnia regilla Nelson & Baumann

Figs. 137–140, 242, map Fig. 262

Capnia regilla Nelson & Baumann 1987c: 508.

HOLOTYPE.—Male (and female allotype), California, Marin Co., Point Reyes National Seashore, Bear Valley Creek, 25 May 1975, D. G. Denning; (USNM).

DIAGNOSIS.—This species is distinguished from other members of the group by features of the male epiproct and tergal knobs and the subgenital plate of the female. *Capnia regilla*

is distinguished from *C. californica*, *C. ophiona*, and *C. quadrituberosa* by its lacking tergal knobs on segment 8. It is further separated from members of these species by the presence of a two-lobed upper process of the male epiproct and the inflated region below the lower process. *Capnia regilla* may be separated from *C. ventura* and *C. saratoga* by the bifid tip of the lower process and the single-lobed upper process of the epiproct. The female of *C. regilla* is closely allied to the above species as judged by the presence of the medial angular flap on the subgenital plate. Characters for separating the females within this subgroup are lacking at this time.

DISTRIBUTION.—CALIFORNIA: Marin Co.; (27). 14 March–25 May.

Capnia saratoga Nelson & Baumann

Figs. 141–144, 243, map Fig. 262

Capnia saratoga Nelson & Baumann 1987c: 505.

HOLOTYPE.—Male (and female allotype), California, Santa Clara Co., small creek near Saratoga, 25 February 1940, S. G. Jewett, Jr.; (USNM).

DIAGNOSIS.—This species is distinguished from *C. californica*, *C. ophiona*, and *C. quadrituberosa* by the undivided tip of the lower process of the epiproct and the presence of a single pair of tergal knobs. It is separated from *C. umpqua* and *C. jewetti* on the basis of the wide area between the dorso-medial membranous area of the epiproct and the tip of the lower process. The extremely shortened upper process in this species separates it from the males of *C. regilla* and *C. ventura*. The male is further distinguished from that of *C. ventura* by the upcurving lower margin of the epiproct (Fig. 144). The female of this species belongs to the group of species having an overhanging angular appendage on the subgenital plate (Fig. 243).

DISTRIBUTION.—CALIFORNIA: Santa Clara Co.; (4). 25 February.

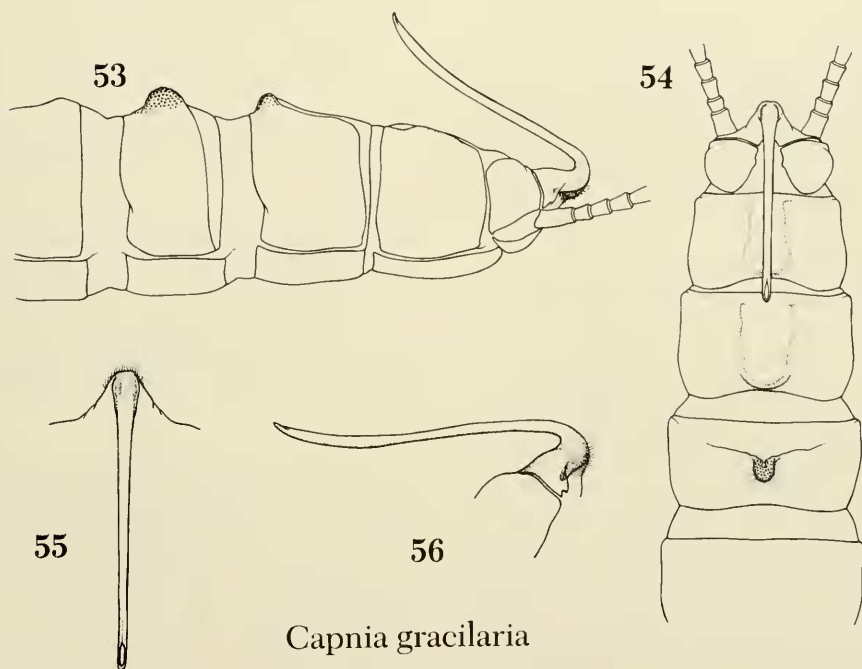
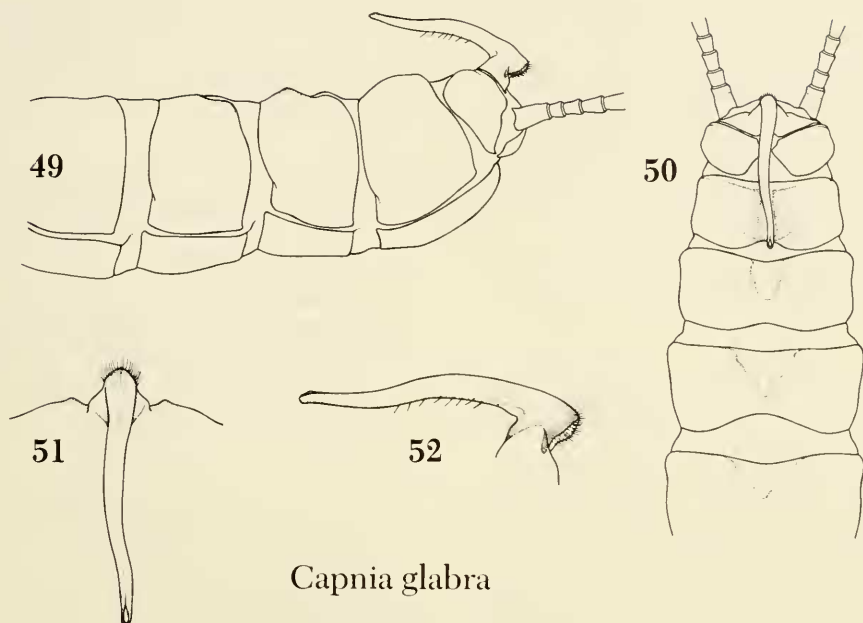
Capnia umpqua Frison

Figs. 177–180, 252, map Fig. 263

Capnia umpqua Frison 1942: 65. Hanson 1946: 239. Jewett 1959: 48, 1960: 146. Illies 1966: 148. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Oregon, Douglas Co., Umpqua River, 21 February 1939, S. G. Jewett, Jr.; (INHS).

DIAGNOSIS.—This species is most closely related to *C. jewetti*, from which it may be



Figs. 49–52. *Capnia glabra* Claassen: 49, male terminalia, lateral; 50, male terminalia, dorsal; 51, male epiproct, dorsal; 52, male epiproct, lateral. California, Placer Co., Ward Creek, Hwy 89, near Lake Tahoe, 22 February 1985, R. W. Baumann and C. R. Nelson.

Figs. 53–56. *Capnia gracilaria* Claassen: 53, male terminalia, lateral; 54, male terminalia, dorsal; 55, male epiproct, dorsal; 56, male epiproct, lateral. Montana, Missoula Co., Rattlesnake Creek above Greenough Park, Missoula, 17 March 1969, R. W. Baumann.

separated by the absence of paired tergal knobs on segments 5 and 6. *Capnia umpqua* has paired knobs only on segment 9. The females of the two species are similar and their ranges overlap in the Willamette basin.

DISTRIBUTION.—CALIFORNIA: Alameda Co.; Contra Costa Co.; Humboldt Co.; Marin Co.; Mendocino Co.; Monterey Co.; Orange Co.; Santa Clara Co.; Shasta Co.; Sonoma Co.; Stanislaus Co.; Trinity Co. OREGON: Curry Co.; Douglas Co.; Josephine Co.; Linn Co.; Marion Co.; Polk Co.; (518). 25 January–2 April.

Capnia ventura Nelson & Baumann
Figs. 189–192, 255, map Fig. 262
Capnia ventura Nelson & Baumann 1957c: 503.

HOLOTYPE.—Male (and female allotype), California, Ventura Co., Wheeler Gorge Campground, North Fork Matilija Creek, 23 January 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—*Capnia ventura* is distinguished from *C. californica*, *C. ophiona*, and *C. quadrituberosa* by having a single pair of tergal knobs and a well-developed upper process. It is separated from the closely related *C. saratoga* (Fig. 144) by the longer upper process of the male epiproct (Fig. 192) and from *C. regilla* (Fig. 140) by the longer lower process. All three of these closely related species are allopatric.

DISTRIBUTION.—CALIFORNIA: Santa Barbara Co.; Ventura Co.; (73). 23–24 January.

Coloradensis Group

The members of this small group are united on the basis of a synapomorphic downward bending of the tip of the male epiproct. They were probably derived from an ancestor of the *decepta* group. The three members of the group are *C. coloradensis* Claassen, *C. hitchcocki* Nelson & Baumann, and *C. petila* Jewett. The group status of this assemblage is somewhat tenuous because of the variable location of the tergal knob. The overall shape of the epiproct, including the drooping tip and straight shaft, along with the similarities of the darkened plates of the females, however, are interpreted as being apomorphic, indicating that a monophyletic relationship may exist.

DISTRIBUTION.—Members of the group live in streams of the central and southern Rocky Mountains and as an apparently isolated pop-

ulation south of San Francisco Bay. All three species tend to emerge later, in March and April. This characteristic late emergence is unusual because of their occurrence at low elevations where they could be expected to emerge earlier in the year.

Key to the Males of the Coloradensis Group

- 1. Tergal knob on segment 7 (Fig. 121) *petila* Jewett
- Tergal knob on segment 8 2
- 2(1). Tergal knob strongly tuberculate; epiproct widening slightly toward tip in lateral view (Fig. 21) *coloradensis* Claassen
- Tergal knob weakly differentiated; epiproct narrowing toward tip or of uniform width throughout length in lateral view (Fig. 60) *hitchcocki* Nelson & Baumann

Key to the Females of the Coloradensis Group

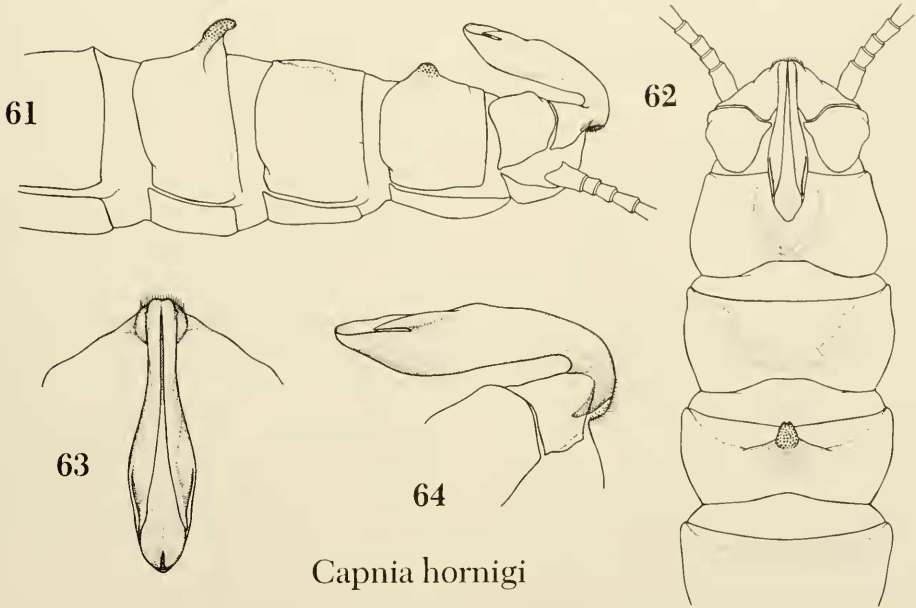
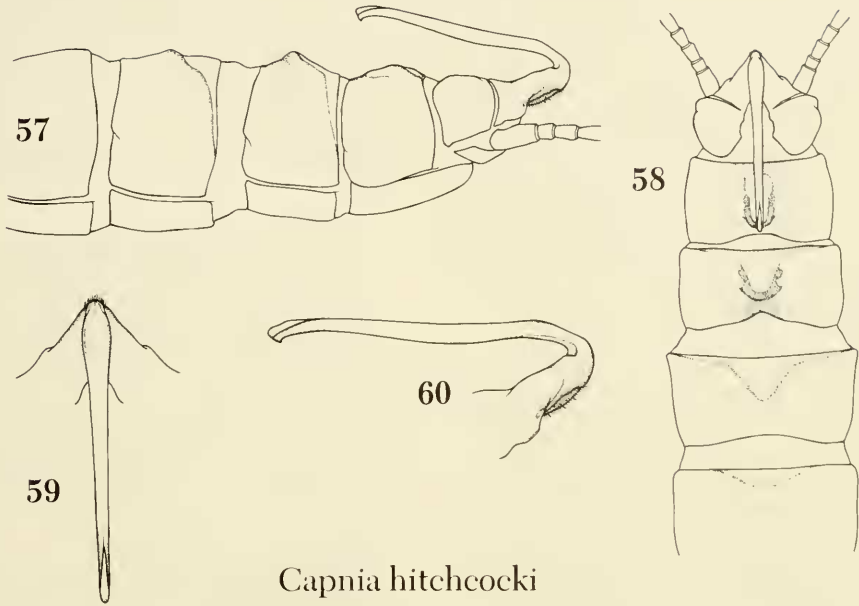
- 1. Subgenital plate much darker than surrounding sclerites (Figs. 215, 223) 2
- Subgenital plate evident, but not much darker than surrounding sclerites (Fig. 238) *petila*
- 2(1). Subgenital plate trapezoidal, with short, parallel side forming posterior margin, sides of plate notched near posterior margin (Fig. 223) *hitchcocki*
- Subgenital plate not trapezoidal, posterior margin rounded, lateral notches lacking (Fig. 215) *coloradensis*

Capnia coloradensis Claassen

Figs. 21–24, 215, map Fig. 264
Capnia coloradensis Claassen 1937: 79, 1940: 92. Hanson 1946: 238. Gaufin 1964a: 223. Ricker 1965: 487. Gaufin et al. 1966: 48. Illies 1966: 134. Knight and Gaufin 1966: 669, 1967: 348. Nebeker and Gaufin 1966: 38, 1967a: 419, 1968: 2. Logan and Smith 1966: 1. Baumann et al. 1977: 66. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Colorado, El Paso Co., Seven Falls, N Cheyenne Canyon, 3 August 1921; (CU).

DIAGNOSIS.—The male of this species may be distinguished from any other in the genus by its having a tubelike epiproct, with the extreme tip dropping downward as a blunt extension, and a prominent tergal knob on segment 8. The female has a subgenital plate similar to that of some members of the *decepta* group, a dark, heavily sclerotized plate which has several lighter lines running longitudinally. The female has a darker plate than the other members of the group. Ricker (1965) was correct in redescribing the female of this species; the female drawing given by Claassen



Figs. 57–60. *Capnia hitchcocki* Nelson and Baumann: 57, male terminalia, lateral; 58, male terminalia, dorsal; 59, male epiproct, dorsal; 60, male epiproct, lateral. California, Alameda/Santa Clara County line, Arroyo Mocho Creek, 20 miles south of Livermore, San Antonio Valley Road, 19 March 1985, R. W. Baumann and C. R. Nelson.

Figs. 61–64. *Capnia hornigi* Baumann & Sheldon: 61, male terminalia, lateral; 62, male terminalia, dorsal; 63, male epiproct, dorsal; 64, male epiproct, lateral. Nevada, Esmeralda Co., White Mountains, Middle Creek, 10 February 1977, A. L. Sheldon.

(1937) appears to be *Utacapnia logana* (Nebecker & Gaufin). The record of *C. decepta* (Banks 1907b, as *Arsapnia decepta*) from Alberta is most probably a female of this species.

DISTRIBUTION.—ALASKA: Anchorage, 10 miles southeast; Kantishna Hills, Denali National Park. ALBERTA: Athabasca River, Jasper National Park, 4,180 feet; Lobstick River at Highway 16. BRITISH COLUMBIA: Kelsall Lake area; Meadow Creek, Highway 3; Manning Provincial Park, Similkameen River; Mosquito Flats, Chilkat Pass; Moyie River above lake; Shingle Creek; Tesla River, Stone Mountain Provincial Park. COLORADO: El Paso Co.; Grand Co.; Gunnison Co.; Hinsdale Co.; Jackson Co.; Lake Co.; Larimer Co.; Mineral Co.; Routt Co.; San Juan Co. IDAHO: Adams Co.; Benewah Co.; Blaine Co.; Boise Co.; Bonner Co.; Cassia Co.; Clearwater Co.; Custer Co.; Fremont Co.; Idaho Co.; Latah Co.; Shoshone Co.; Teton Co.; Valley Co. MONTANA: Broadwater Co.; Gallatin Co.; Lincoln Co.; Meagher Co.; Ravalli Co. NEW MEXICO: Taos Co. UTAH: Box Elder Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Sublette Co.; Teton Co. YUKON TERRITORY: Kluane, Boutellier Creek; Christmas Creek; North Fork Pass, Ogilvie Mountains; (747). 29 January–July.

Capnia hitchcocki Nelson & Baumann

Figs. 57–60, 223, map Fig. 265

Capnia lineata Hitchcock 1958: 80. Jewett, 1960: 145.

Capnia hitchcocki Nelson & Baumann 1987c: 512.

HOLOTYPE.—Male (and female allotype), California, Alameda/Santa Clara County line, Arroyo Mocho Creek, 20 miles south of Livermore, San Antonio Valley Road, 19 March 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—The epiproct of this species is very similar to that of *C. petila*, although the latter species is much smaller. The two species are distinguished on the basis of the tergal knob, which is on segment 7 in *C. petila* and on segment 8 of *C. hitchcocki*. The heavily colored subgenital plate of the female is dissimilar from any other winter stoneflies that would be collected in the streams of this region. The dark brown, notched plate might be confused with that of members of the Barberi group, but in that group the plate is black, the color of which seems to be external. The dark brown color of the female of *C. hitchcocki* is

internal, overlain by lighter sclerotization. This species was originally collected in the 1950s and identified as *C. lineata*. The smaller size, the presence of a diminutive tergal knob, and the dark female plate differentiate this species from *C. lineata*.

DISTRIBUTION.—CALIFORNIA: Alameda Co.; Santa Clara Co.; Stanislaus Co.; (27). 19 March.

Capnia petila Jewett

Figs. 121–124, 238, map Fig. 265

Capnia petila Jewett 1954b: 546, 1959: 47. Illies 1966: 145. Nebecker and Gaufin 1967a: 235, 1967b: 418, 1968: 3. Newell 1970: 50. Zwick 1973: 376. Baumann et al. 1977: 73. Stark et al. 1986: 385.

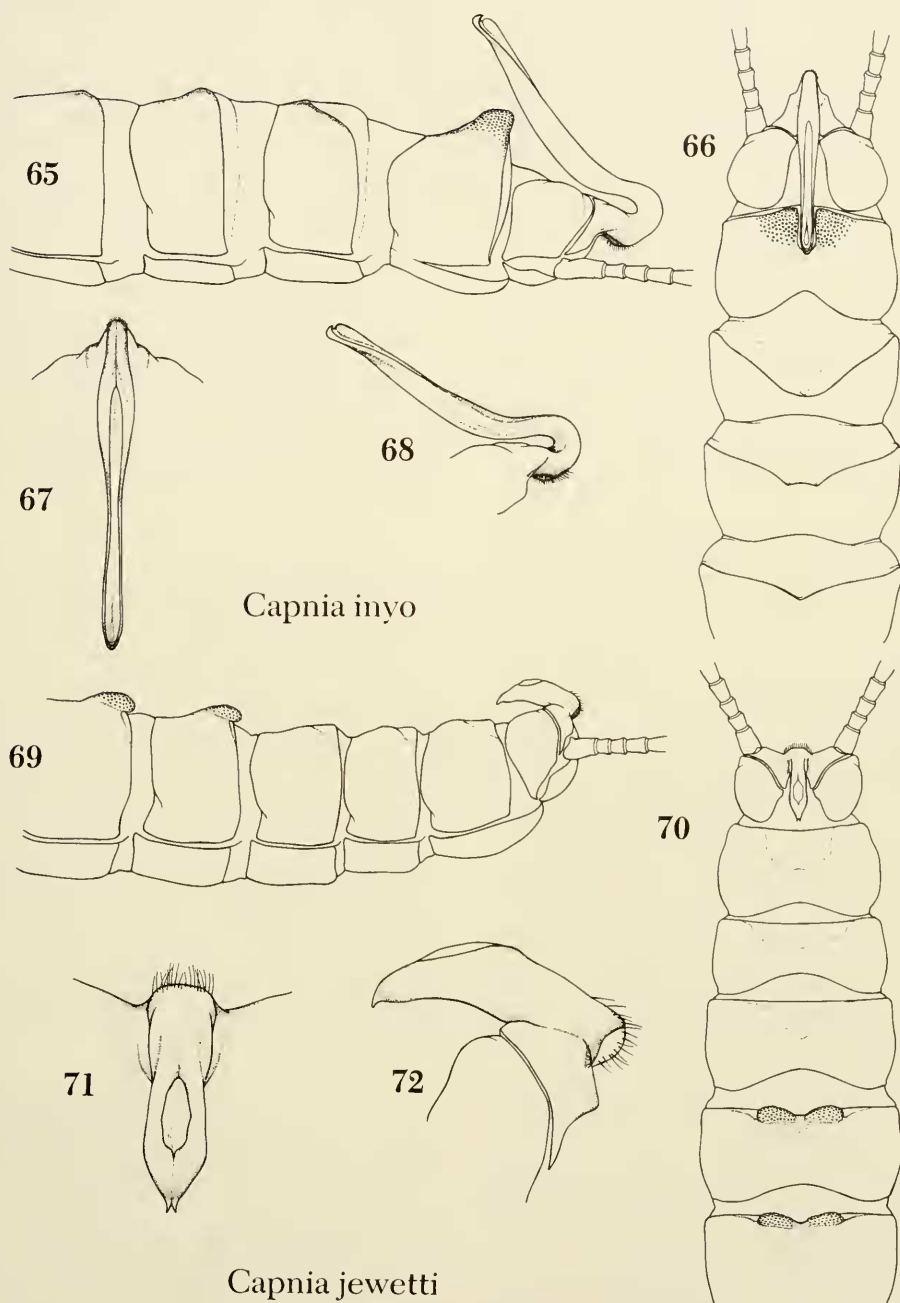
HOLOTYPE.—Male, Oregon, Baker Co., Spring Creek, tributary of Powder River, 30 March 1952, J. H. Baker; (CAS). Female allotype, Montana, Ravalli Co., Big Creek; (USNM).

DIAGNOSIS.—The male of this species resembles a small *C. coloradensis*, from which it is easily distinguished by the presence of the tergal knob on abdominal segment 7 in *C. petila* and on segment 8 in *C. coloradensis*. The subgenital plates of these two species are similar in shape, but that of *C. coloradensis* is much darker and more well defined (Fig. 238).

DISTRIBUTION.—ALASKA: Caribou Creek, Utladuct; Talkeetna, Fern Mine Road; Monument Creek tributary of Chena River; West Fork Chena River. ALBERTA: Banff National Park. BRITISH COLUMBIA: Lytton, Botanie Lake; Manning Provincial Park, Similkameen River. IDAHO: Boise Co.; Bonneville Co.; Custer Co.; Idaho Co. MONTANA: Broadwater Co.; Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Missoula Co.; Ravalli Co. OREGON: Baker Co. UTAH: Box Elder Co. WYOMING: Park Co.; Sublette Co. YUKON TERRITORY: Kluane, Boutellier Creek; (267). 7 March–16 August.

Decepta Group

The *C. decepta* group forms a cluster of closely related species. The species included in this group are: *C. arapahoe* Nelson & Kondratieff, *C. coyote* Nelson & Baumann, *C. decepta* (Banks), *C. pileata* Jewett, *C. teresa* Claassen, *C. sequoia* Nelson & Baumann, *C. tumida* Claassen, and *C. utahensis* Gaufin & Jewett.



Figs. 65–68. *Capnia inyo* Nelson & Baumann: 65, male terminalia, lateral; 66, male terminalia, dorsal; 67, male epiproct, dorsal; 68, male epiproct, lateral. California, Inyo Co., Independence Creek, Grays Meadow Campground, 25 January 1985, R. W. Baumann and C. R. Nelson.

Figs. 69–72. *Capnia jewetti* Frison: 69, male terminalia, lateral; 70, male terminalia, dorsal; 71, male epiproct, dorsal; 72, male epiproct, lateral. Oregon, Benton Co., Muddy Creek, 17 February 1985, G. R. Fiala.

Arsapnia decepta was described by Banks from Fort Collins, Colorado, in 1897 in a new genus. Claassen (1924) placed *Arsapnia* in synonymy with *Capnia* Pictet after a careful study of Pictet's description and figures of the European type-species, *C. nigra*. Claassen (1924) described the males of *C. tumida* and *C. teresa* based on California material. The female of *C. tumida* was described by Frison (1942), who included figures of the male based on material from Portland, Oregon. Later Jewett (1966) described *C. pileata* from specimens taken at the same locality from which Frison described the female of *C. tumida*. *Capnia pileata* Jewett was named from the description of the female given by Frison (1942), the figures of both male and female given by Frison (1942), and the diagnosis given in Jewett (1966). Jewett (1966) also described a female allotype for *C. tumida* and presented figures of both the male and the female of this species. Another species belonging to this group, *C. barbata* Frison (1944), was named from material from Longmount (correct spelling is Longmont), Colorado. The differences between this species and *C. decepta* fall within the range of variability found in series of *C. decepta*. Additionally, the type localities of *C. barbata* and *C. decepta* are less than 25 miles apart. We place *C. barbata* in synonymy under *C. decepta*, which has priority.

The following combination of characters distinguishes the *decepta* group from other members of the genus: a large, expanded epiproct consisting of a neck, bulb, and tip, the parts differentiated from each other by degree of gibbosity (Figs. 209, 210); a dorsal tubercle on tergum 7 of the male abdomen that is produced posteriorly into a knob covered with several types of sensillae and which is bifid to varying degrees; and a subgenital plate in the female that is darkly sclerotized and is approximately two-fifths the width of sternum 8. Both sexes are macropterous.

A knowledge of the following terms will facilitate identification when using the key to this group. These defined features are shown in Figures 209, 210. The epiproct is the recurved appendage of tergum 11 of the male which serves as an intromittent organ. The epiproct is divided into three regions including the neck, bulb, and tip. The neck serves as the basal attachment of the epiproct to the

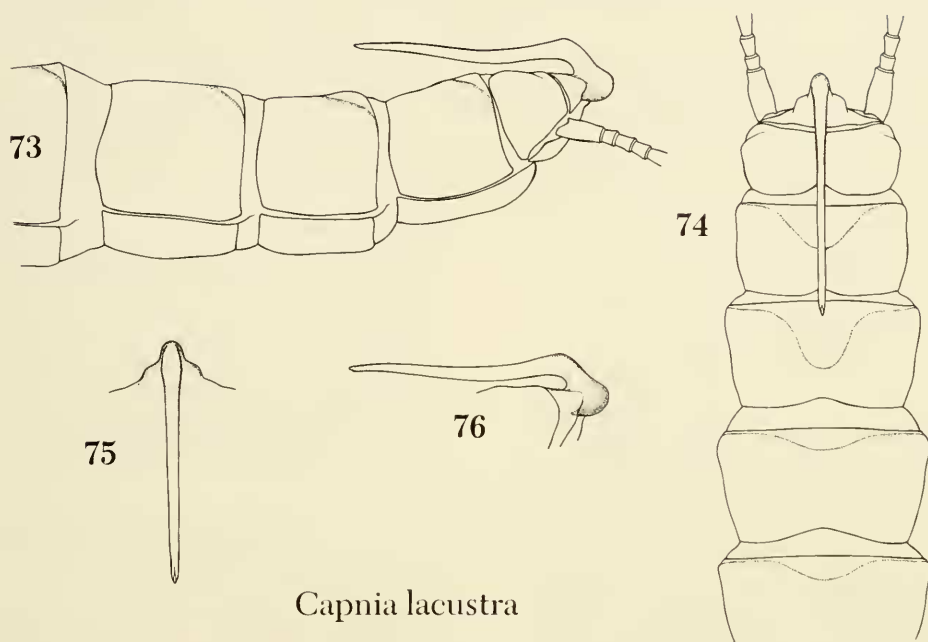
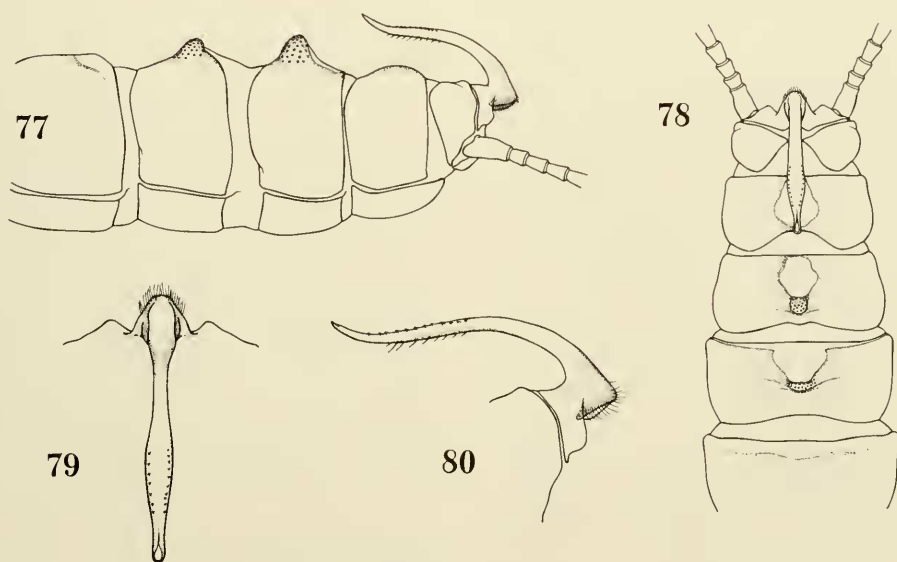
remainder of tergum 11. The bulb is the region distal to the neck and is inflated to varying degrees in different species of this group. The limits between the neck and bulb are somewhat arbitrary in some specimens but are generally distinct. The slope where the neck and bulb meet is the posterior declivity. The tip of the epiproct is the narrow, attenuated structure that joins the bulb at the anterior declivity. Dorsal bristles of several sizes are generally present on the leading edge of the dorsal margin of the anterior declivity. They are absent in specimens of *C. sequoia*. A specimen viewed from the dorsal aspect will show a median furrow that divides the tip and bulb in half on the upper surface. The extent of widening of this furrow has some taxonomic value in distinguishing species. The lower surface of the epiproct lacks any dividing furrows or sutures.

DISTRIBUTION.—The members of this group inhabit smaller streams in western North America from Vancouver Island south to coastal Oregon and then inland down the southern Cascade Mountains and Sierra Nevada to the ranges of mountains surrounding the Los Angeles basin. Other members of the group are then found south and eastward in Arizona, New Mexico, Colorado, and Mexico in streams that drain immediately from the bases of the Southern Rocky Mountains and the island mountains that dot the desert in those areas. These species apparently live in a transition zone between the mountains and the Great Plains on the eastern portion of their range. One unconfirmed record of *C. decepta* from Banff, Alberta, exists in the literature (Banks 1907b); this record is probably from a female of *C. coloradensis*.

This group is conspicuously absent from the main mass of the Rocky Mountains (except a record of a female of *C. decepta* from Steamboat Springs, Routt County, Colorado, reported by Needham and Claassen [1925], which could easily have been a mistaken determination of the female of *C. coloradensis* Claassen). This group is also absent from the Great Basin.

Key to the Males of the Decepta Group

1. Bulb of epiproct spherical; sides of posterior declivity bearing fine bristles; tip of epiproct narrow and short, approximately one-half the length of epiproctal bulb (Figs. 167, 168); mountains surrounding Los Angeles basin *teresa* Claassen

*Capnia lacustra**Capnia licina*

Figs. 73–76. *Capnia lacustra* Jewett: 73, male terminalia, lateral; 74, male terminalia, dorsal; 75, male epiproct, dorsal; 76, male epiproct, lateral. California, El Dorado Co., Lake Tahoe, Emerald Bay, depth 116–198 feet, 11 July 1962, T. C. Frantz and A. J. Cordone.

Figs. 77–80. *Capnia licina* Jewett: 77, male terminalia, lateral; 78, male terminalia, dorsal; 79, male epiproct, dorsal; 80, male epiproct, lateral. Washington, Whatcom Co., North Fork Nooksack River, 11 miles east of Glacier, 1,900 feet, 18 February 1966, K. E. Vander Mey.

- Bulb of epiproct not spherical; sides of posterior declivity lacking bristles although bristles may be present on upper surface of the neck of epiproct 2
- 2(1). Epiproct four or more times as long as deep in lateral view, lacking inflated bulb (Figs. 4, 184) .. 3
- Epiproct about three times as long as deep in lateral view, inflated epiproctal bulb present (Figs. 32, 36, 152, 172) 4
- 3(2). Tergum 7 bearing distinct knob (Fig. 1); epiproct about seven times as long as wide in dorsal view (Fig. 3), not widened basally *arapahoe* Nelson & Kondratieff
- Tergum 7 lacking a distinct knob (Fig. 181); epiproct about three times as long as wide, widened near base (Fig. 153) *utahensis* Gaufin & Jewett
- 4(2). Bulb tapering uniformly to meet base of tip gradually when viewed from above (Figs. 31, 35) 5
- Bulb ending abruptly distally, base of tip much narrower than width of distal edge of bulb (Figs. 127, 151, 171) 6
- 5(4). Bulb of epiproct inflated in lateral aspect, especially near anterior declivity; bases of spines on anterior declivity, not above a line drawn along upper margin of posterior declivity (Fig. 36); ratio of greatest length of gibbosity to greatest height of epiproct when measured in lateral view less than 1.9; mountains of Colorado, New Mexico, Mexico, Arizona, and southern Nevada *decepta* (Banks)
- Bulb of epiproct not greatly inflated in lateral aspect but gradually increasing in diameter from neck region and then slowly decreasing in diameter beginning at anterior declivity (Fig. 32); bases of some of the spines of anterior declivity above a line drawn along posterior declivity; epiproctal ratio greater than 2.0; San Bernardino and San Gabriel mountains of southern California *coyote* Nelson & Baumann
- 6(4). Anterior declivity concave (Figs. 127, 128); dorsal bristles on a transverse carina; bulb of epiproct with gibbosity concentrated nearer anterior declivity than neck; northwestern Oregon, northern California *pilcata* Jewett
- Anterior declivity slightly convex (Figs. 152, 172); dorsal bristles in transverse row or clumped or absent, not on a heavy carina but on sloping junction of bulb and anterior declivity; bulb of epiproct with gibbosity extending from neck region to anterior declivity 7
- 7(6). Anterior declivity lacking bristles, sloping evenly from area of greatest gibbosity to apex, carina absent (Figs. 151, 152) *sequoia* Nelson & Baumann
- Anterior declivity with sparse bristles arranged in a row of small but distinct carina on top of anterior declivity (Figs. 171, 172) ... *tumida* Claassen

Key to the Females of the Decepta Group
(including *C. arapahoe* unknown)

- 1. Subgenital plate notched apically (Fig. 249) .. *teresa*

- Subgenital plate entire on posterior margin 2
- 2(1). Subgenital plate joined to sternum 7 (Fig. 239) *pilcata*
- Subgenital plate separated from sternite 7 by intersegmental membrane 3
- 3(2). Subgenital plate as wide as or wider than long (may be wider at base narrowing to distal margin; subgenital plate 0.24–0.35 mm in length (Fig. 250) *tumida*
- Subgenital plate longer than wide; subgenital plate 0.40–0.54 mm in length. 4
- 4(3). Width of subgenital plate one-fourth or less width of sternum 8 (Fig. 253) *utahensis*
- Width of subgenital plate one-third or more width of sternum 8 5
- 5. Inhabiting streams of Mohave River drainage system in southern California (Fig. 217) ... *coyote*
- Inhabiting streams in Spring Mountains, Nevada, Sierra San Pedro Martir, Baja California, and drainages south and east of the Colorado River (Fig. 218) *decepta*

Capnia arapahoe Nelson & Kondratieff

Figs. 1–4, map Fig. 268

Capnia arapahoe Nelson & Kondratieff 1988: 77.

HOLOTYPE.—Male, Colorado, Larimer Co., Elkhorn Creek at junction of Highway 14, 22 miles west of Fort Collins, 2,012 m (6,600'), 3 April 1987, B. C. Kondratieff and P. Zwick; (USNM).

DIAGNOSIS.—*Capnia arapahoe* is placed in the Decepta group based on the presence of a well-differentiated tergal knob on abdominal segment 7 and on the presence of horns on the tip of the epiproct. It differs from other members of the group in lacking a mesal bulbous expansion of the epiproct, and in the slim profile of the epiproct in both dorsal and lateral aspects. This species may be confused with *C. confusa* Claassen based on the general shape of the epiproct, but it can be distinguished from *C. confusa* by the presence of a tuberculate knob on tergum 7 and an epiproct that recurves slightly and bears horns.

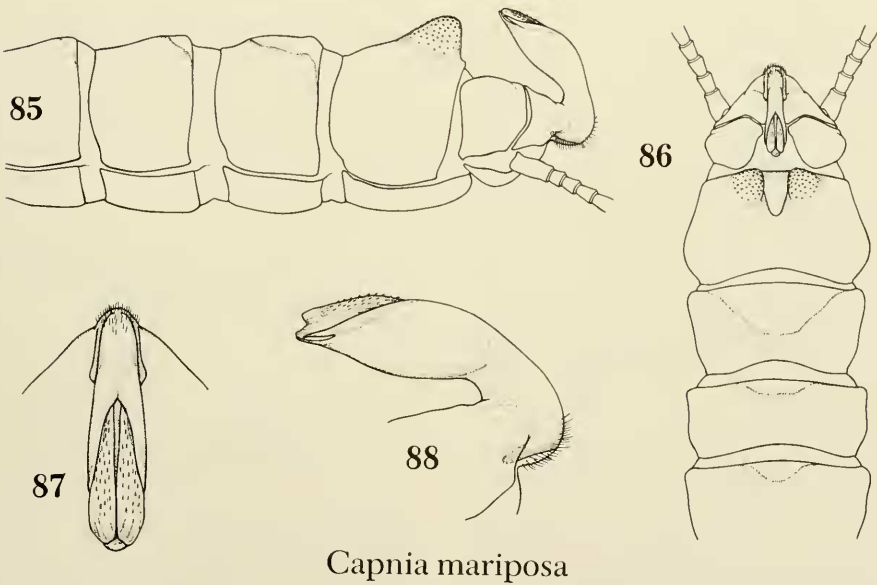
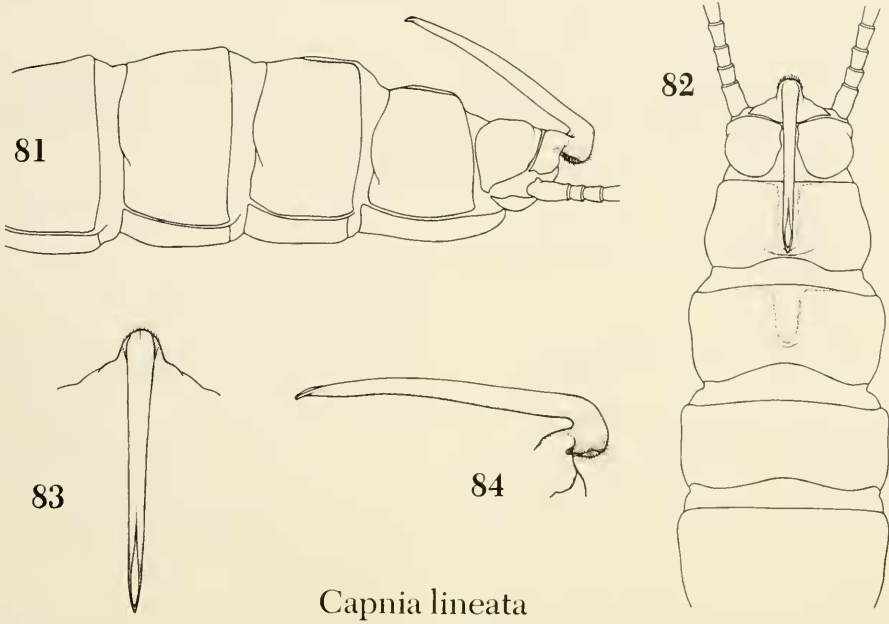
DISTRIBUTION.—COLORADO: Larimer Co., type locality and Young Gulch, above Ansel Watrous Campground, 1,768 m (5,800 feet); (2). 22 March–3 April.

Capnia coyote Nelson & Baumann

Figs. 29–32, 217, map Fig. 267

Capnia coyote Nelson & Baumann 1987c: 487.

HOLOTYPE.—Male, California, Los Angeles Co., Little Rock Creek, Cooper Canyon Campground, San Gabriel Mountains, 31 March 1981, R. W. Baumann and J. A. Stanger; (USNM).



Figs. 81–84. *Capnia lineata* Hanson: 81, male terminalia, lateral; 82, male terminalia, dorsal; 83, male epiproct, dorsal; 84, male epiproct, lateral. Idaho, Latah Co., Little Boulder Creek, Little Boulder Creek Campground, 26 April 1985, R. W. Baumann and C. R. Nelson.

Figs. 85–88. *Capnia mariposa* Nelson & Baumann: 85, male terminalia, lateral; 86, male terminalia, dorsal; 87, male epiproct, dorsal; 88, male epiproct, lateral. California, Mariposa Co., Tuolumne River, Hwy 120, Tuolumne Meadows Campground, 27 June 1985, R. W. Baumann and J. A. Stanger.

DIAGNOSIS.—*Capnia coyote* is the sister species of *C. decepta*. The two are distinguished by the flatter upper surface of the epiproct and the longer gibbosity of the epiproct (as measured by the ratio of gibbosity length to greatest epiproct depth viewed from lateral aspect) in *C. coyote* compared to *C. decepta*. The females of *C. coyote* and *C. decepta* are indistinguishable.

DISTRIBUTION.—CALIFORNIA: Los Angeles Co.; San Bernardino Co.; (16). 27 December–17 March.

Capnia decepta (Banks)

Figs. 33–36, 209–210, 218, map Fig. 267

Arsapnia decepta Banks 1897: 22, 1907a: 15, 1907b: 329. Dodds and Hisaw 1925: 382.

Capnia decepta Needham and Claassen 1925: 264. Claassen 1940: 93. Hanson 1946: 239. Illies 1966: 135. Nebeker and Gaufin 1967b: 418, 1968: 2. Stark et al. 1973: 272, 1986: 385. Baumann et al. 1977: 70.

Capnia barbata Frison 1944: 153. Hanson 1946: 238. Gaufin 1964b: 309. Illies 1966: 132. Jewett 1966: 101. Nebeker and Gaufin 1967a: 246, 1967b: 418, 1968: 2. Stark et al. 1973: 272, 1986: 385. Zwick 1973: 371. Stewart et al. 1974: 514. Baumann et al. 1977: 64. Jacobi and Baumann 1983: 585. *New synonymy*.

HOLOTYPE.—Colorado, Larimer Co., Fort Collins, no date given, C. P. Gillette; (MCZ).

DIAGNOSIS.—This species is distinguished from other members of the group by having the bulb tapered uniformly and gradually to meet the tip when it is viewed from above. The base of the tip of *C. decepta* is wider relative to the width of the anterior declivity of the bulb than that of *C. tumida* and *C. pileata*. *Capnia decepta* is distinguished from *C. coyote* by having an epiproctal ratio of less than 2.0.

DISTRIBUTION.—ARIZONA: Apache Co.; Cochise Co.; Coconino Co.; Gila Co.; Graham Co.; Mohave Co.; Pima Co.; Santa Cruz Co.; Yavapai Co. BAJA CALIFORNIA: Sierra San Pedro Martir, CHIHUAHUA: Sierra Madre Occidental. COLORADO: Arapahoe Co.; Boulder Co.; Larimer Co. NEVADA: Clark Co. NEW MEXICO: Catron Co.; Grant Co.; Lincoln Co.; Rio Arriba Co.; San Miguel Co.; Santa Fe Co.; Sierra Co.; Socorro Co.; Taos Co.; Tarrant Co.; (650). 27 December–24 April.

NOTE.—An Alberta record (Banks 1907b) of this species is far from any other known records. This specimen was not examined

during this study but probably represents a female of *C. coloradensis*.

Capnia pileata Jewett

Figs. 125–128, 239, map Fig. 268

Capnia pileata Jewett 1966: 104. Zwick 1973: 77. Ricker and Scudder 1975: 339. Stark et al. 1986: 385.

Capnia tumida Frison 1942: 65. Ricker 1943: 98. Jewett 1959: 48.

HOLOTYPE.—Male (and female allotype), Portland, Oregon, Johnson Creek at 82nd Street, S. G. Jewett, Jr., 3 February 1939; (INHS).

DIAGNOSIS.—The male is distinguished from other species in the group by the concave anterior declivity of the epiproct, the presence of bristles forming a transverse row on a carina along the upper edge of the anterior declivity, and the concentration of the swelling of the bulb near that same region as opposed to the swollen area located nearer the neck region as in *C. tumida*.

The female differs from others in the group in the fusion of the anterior margin of the subgenital plate with the posterior margin of sternum 7.

DISTRIBUTION.—BRITISH COLUMBIA: Vancouver Island: Nanaimo, creeks and Millstone River. CALIFORNIA: Shasta Co.; Siskiyou Co. OREGON: Benton Co.; Clackamas Co.; Columbia Co.; Josephine Co.; Multnomah Co.; Yamhill Co.; (100). 15 January–10 April.

Capnia sequoia Nelson & Baumann

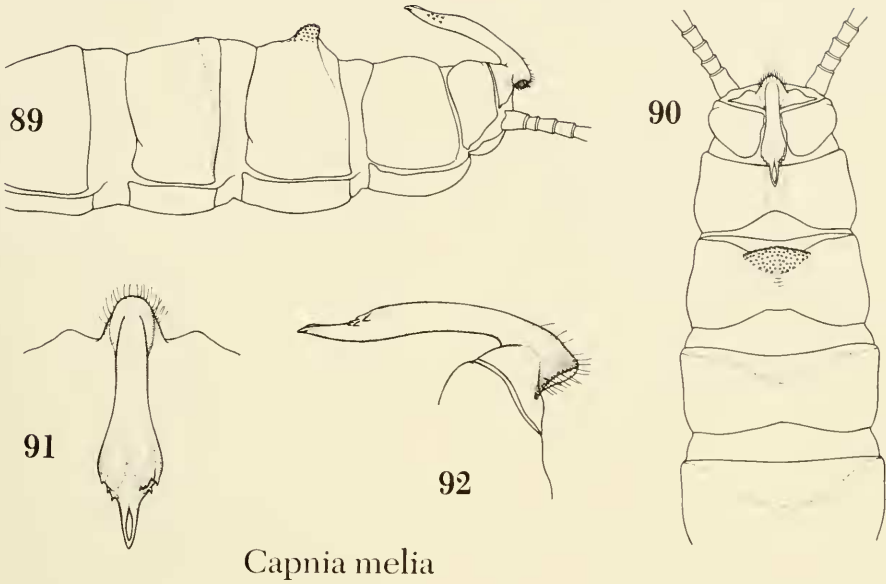
Figs. 149–152, 245, map Fig. 268

Capnia sequoia Nelson & Baumann 1987c: 489. Nelson & Baumann 1987d: 224.

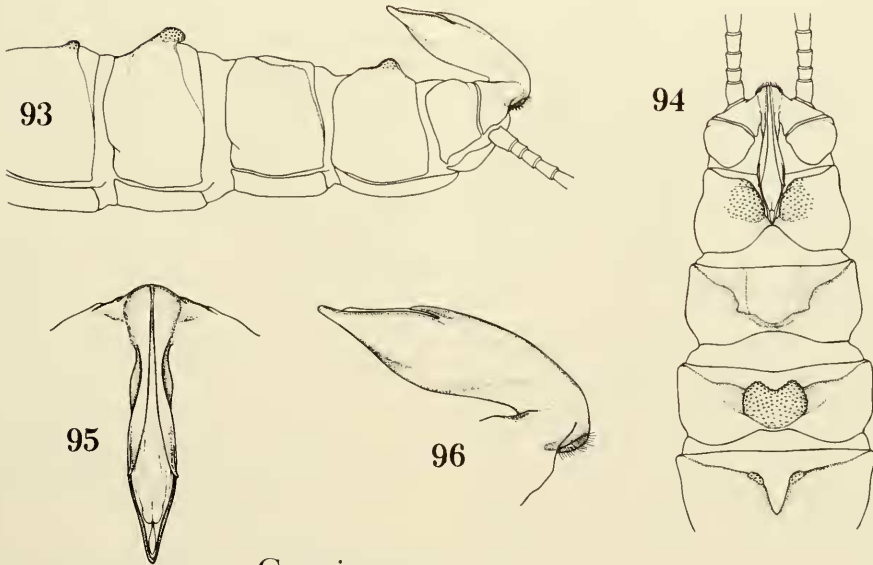
HOLOTYPE.—Male (and female allotype), California, Tuolumne Co., Ackerson Creek, Evergreen Lodge Road, 18 March 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—This species is most closely related to *C. tumida*, from which males differ in the following characters: the anterior declivity of *C. sequoia* never has spines while that of *C. tumida* is variable in having few to many spines, from the lateral aspect this species (Fig. 152) is flatter and lacks a distinct earinate ridge at the junction of the tip and the bulb on the anterior declivity. The females of the two species are indistinguishable.

DISTRIBUTION.—CALIFORNIA: Fresno Co.; Mariposa Co.; Tulare Co.; Tuolumne Co.; (62). 16 December–22 June.



Capnia melia



Capnia mono

Figs. 89–92. *Capnia melia* Frison: 89, male terminalia, lateral; 90, male terminalia, dorsal; 91, male epiproct, dorsal; 92, male epiproct, lateral. Oregon, Clackamas Co., Wildeat Creek, Hwy 36, 1 mile east of Alder Creek, 2 March 1984, R. W. Baumann, C. R. Nelson, and G. R. Fiala.

Figs. 93–96. *Capnia mono* Nelson & Baumann: 93, male terminalia, lateral; 94, male terminalia, dorsal; 95, male epiproct, dorsal; 96, male epiproct, lateral. California, Mono Co., Slinkard Creek, 2 miles north of Topaz, 5 November 1983, W. D. Shepard, reared from nymph in laboratory.

Capnia teresa Claassen

Figs. 165–168, 249, map Fig. 267

Capnia teresa Claassen 1924: 54, 1940: 95. Needham and Claassen 1925: 262. Hanson 1946: 239. Jewett 1956: 170, 1960: 146. Illies 1966: 147. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Los Angeles Co., Evey Canyon, Claremont, 15 October 1922; (CU, vial located, specimen lost).

DIAGNOSIS.—The male of this species is distinguishable from other members of the group by the nearly spherical bulb of the epiproct and the presence of bristles on the sides of the bulb near the posterior declivity. The tip of the epiproct is very thin, nearly bristlelike in this species. Other species in the group lack these characters. The female is readily separated from others in the group by the notched subgenital plate.

FEMALE DESCRIPTION.—Wings macropterous, length of forewing 6.9 mm; length of body 6.8 mm. General appearance similar to male. Dorsal membranous stripe from abdominal tergum 1 to 8. Abdominal tergum 8 with small, triangular sclerite located centrally on midline of tergum. Subgenital plate consisting of a recessed, bilobed, sclerotized flap, divided by a medial indentation, one-third to one-half the length of the sclerotized portion of the plate. Darkest portion of subgenital plate forming a medial triangle with the apex directed posteriorly. Subgenital plate separated from sternum 7 by unsclerotized intersegmental membrane. Pleural membrane of abdominal segment 7 bearing a small sclerite.

MATERIAL.—Female, California, Riverside Co., San Jacinto Mountains, Herkey Creek, Herkey Creek Campground, 19 January 1985, R. W. Baumann and C. R. Nelson; (BYU).

DISTRIBUTION.—CALIFORNIA: Riverside Co.; San Bernardino Co.; (300). 24 December–20 March.

Capnia tumida Claassen

Figs. 169–172, 250, map Fig. 268

Capnia tumida Claassen 1924: 56, 1940: 95. Needham and Claassen 1925: 261. Frison 1942: 65 (see Jewett 1966). Ricker 1943: 98 (see *C. pilcata*). Hanson 1946: 239. Jewett 1956: 170, 1959: 48, 1960: 146, 1966: 106. Ricker 1965: 68. Illies 1966: 148. Zwick 1973: 379. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Plumas Co., Sunnyside Mine near Seneca, 25–26 December 1922, H.S. Barber; (USNM). Female

allotype, California, El Dorado Co., creek about 5 miles west of Pyramid Campground, Highway 50, 22 May 1964, S. G. Jewett, Jr.; (CAS).

DIAGNOSIS.—The male of *C. tumida* is distinguished from other members of the group by the shape of the epiproct bulb and its anterior declivity. The bulb ends distally with the demarcation of the bulb from the base of the tip being abrupt, the width of the base of the tip being much narrower than the distal face of the bulb (from dorsal aspect, Fig. 171). These characters distinguish *C. tumida* from *C. decepta* and *C. coyote*. It is separated from the related *C. pileata* by the following characters: the anterior declivity is convex or flat, never concave as in *C. pileata*, the bristles of the anterior declivity are not situated on a well-defined carina, and the swollen portion of the bulb is located near the center of its length, not concentrated near the anterior declivity as in *C. pileata*. It differs from *C. sequoia* in having spines on the anterior declivity and having a more angular anterior declivity.

The female is distinguished from related species by its subgenital plate, which is square or nearly square and not fused to sternum 7 along its anterior margin. The subgenital plate is longer than wide in *C. decepta*, notched in *C. teresa*, and fused to sternum 7 in *C. pileata*. The females of *C. tumida* and *C. sequoia* are indistinguishable.

DISTRIBUTION.—CALIFORNIA: Alpine Co.; El Dorado Co.; Placer Co.; Plumas Co.; Sacramento Co.; Shasta Co.; Sierra Co.; Siskiyou Co.; Tehama Co. NEVADA: Washoe Co.; (200). 9 December–22 May.

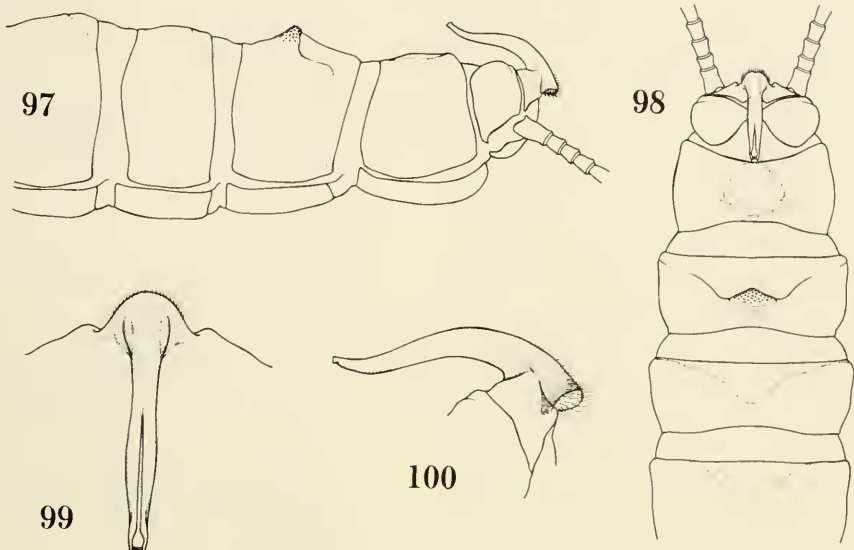
Capnia utahensis Gaufin & Jewett

Figs. 181–184, 253, map Fig. 268

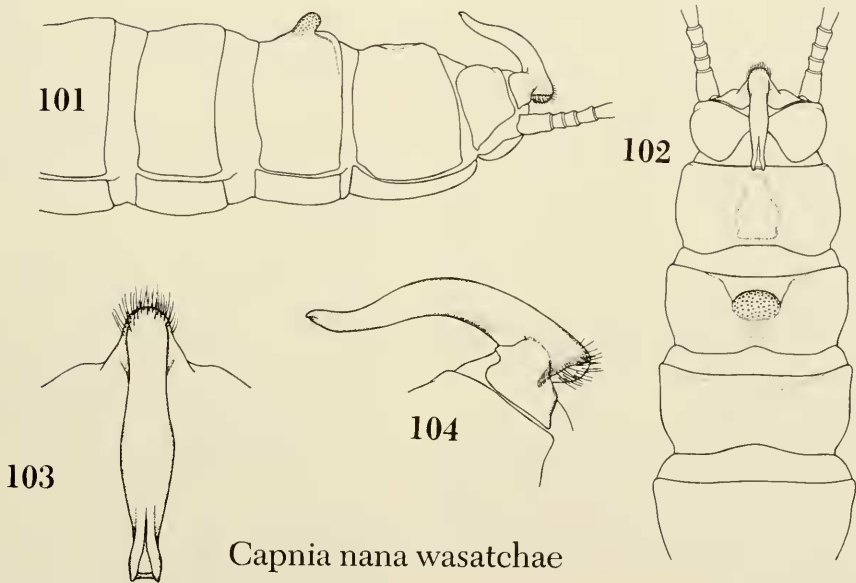
Capnia utahensis Gaufin and Jewett 1962: 69. Gaufin 1964a: 223, 1966: 49. Illies 1966: 148. Nebeker and Gaufin 1967a: 418, 1968: 3. Baumann et al. 1977: 74. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Utah, Beaver Co., Beaver Creek, 21 March 1959, A. R. Gaufin; (CAS).

DIAGNOSIS.—This species is most closely allied to *C. sequoia*, from which it differs in having the tergal knob on segment 7 much reduced or virtually absent and the epiproct much flatter and narrower. The females are not easily separated, but the subgenital plate of this species is slightly narrower. Current data indicate that the distributions of the two



Capnia nana nana



Capnia nana wasatchae

Figs. 97–100. *Capnia nana nana* Claassen: 97, male terminalia, lateral; 98, male terminalia, dorsal; 99, male epiproct, dorsal; 100, male epiproct, lateral. British Columbia, Terrace, 1936, M. E. Hippisley.

Figs. 101–104. *Capnia nana wasatchae* Nebeker & Gaufin: 101, male terminalia, lateral; 102, male terminalia, dorsal; 103, male epiproct, dorsal; 104, male epiproct, lateral. Utah, Cache Co., Logan Canyon, Springhollow, tributary of Logan River, 4 January 1984, C. R. Nelson and S. A. Wells.

species do not overlap. However, more collecting needs to be done on the west slope of the southern Sierra Nevada before the distributional limits of these two species are definitive in that area.

DISTRIBUTION.—CALIFORNIA: Inyo Co.; Kern Co., Cedar Creek, Highway 155, Cedar Creek Campground, 2 May 1981, Baumann and Stanger; same locality, 15 March 1985, Baumann and Nelson; Kern Co., Slick Rock Creek, Highway 155, west of Greenhorn Summit, 15 March 1985, Baumann and Nelson; Mono Co.; Tulare Co., Soda Creek, Highway 190, west of Pierpoint Springs, 16 March 1985, Baumann and Nelson. NEVADA: Esmeralda Co.; Lander Co.; Nye Co.; White Pine Co. UTAH: Beaver Co.; Iron Co.; Juab Co.; Millard Co.; Piute Co.; Sevier Co.; Utah Co.; Washington Co.; (865). 28 December–14 May.

Excavata Group

This group includes three species, *C. cheama* Ricker, *C. excavata* Claassen, and *C. uintahi* Gaufin. The group is unique among *Capnia* in having the epiproct produced as a broad, flat, lateral flange at about midlength of the shaft. This group is most closely allied to the *nana* group, based on the presence of a well-developed tergal knob on segment 8. The tergal knob of this group is more highly modified than that of the *nana* group, and in unrelaxed specimens it is common for the knob to obscure the tip of the epiproct up to the point of the lateral flange. For proper species identification the specimens should be relaxed so that details of the tip of the epiproct are visible.

DISTRIBUTION.—The distributional area covered by the group is large, ranging from Alaska and Alberta on the north to central California and Colorado on the south. The three species in the group are allopatric and widely separated.

Key to the Males of the Excavata Group

- 1. Knob on tergum 8 divided into two distinct, tuberculate knobs in lateral view; epiproct with tip short and pointed (Figs. 41, 44); in Pacific coast states and western British Columbia*excavata* Claassen
- Knob on tergum 8 not divided, a single knob in lateral view; epiproct with tip longer and blunt; ranging farther inland 2

- 2(1). Lateral flange of epiproct very broad and flattened (Fig. 175); tip of epiproct simple, not bearing a projection on upper margin (Fig. 176); inhabiting small creeks in some parts of the central Rocky Mountains and adjacent areas*uintahi* Gaufin
- Lateral flange of epiproct not so broad and flat (Fig. 19); tip of epiproct bearing a small projection when viewed laterally (Fig. 20); in large rivers near the border of Montana and British Columbia*cheama* Ricker

Key to the Females of the Excavata Group

- 1. Subgenital plate with posterior margin divided medially (Fig. 214)*cheama*
- Subgenital plate not divided medially 2
- 2(1). Subgenital plate darkly sclerotized throughout, posterior margin not recessed but produced to a point medially, anterior margin of plate entire (Fig. 220)*excavata*
- Subgenital plate not darkly sclerotized, posterior margin recessed and not produced medially, anterior margin of plate with a medial notch (Fig. 251)*uintahi*

Capnia cheama Ricker

Figs. 17–20, 214, map Fig. 266

Capnia cheama Ricker 1965: 484. Nebeker and Gaufin 1967a: 418, 1968: 2. Zwick 1973: 372. Ricker and Scudder 1975: 338. Baumann et al. 1977: 66. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), British Columbia, Fraser River Bridge near Agassiz, 14 March 1958, W. E. Ricker; (CNC).

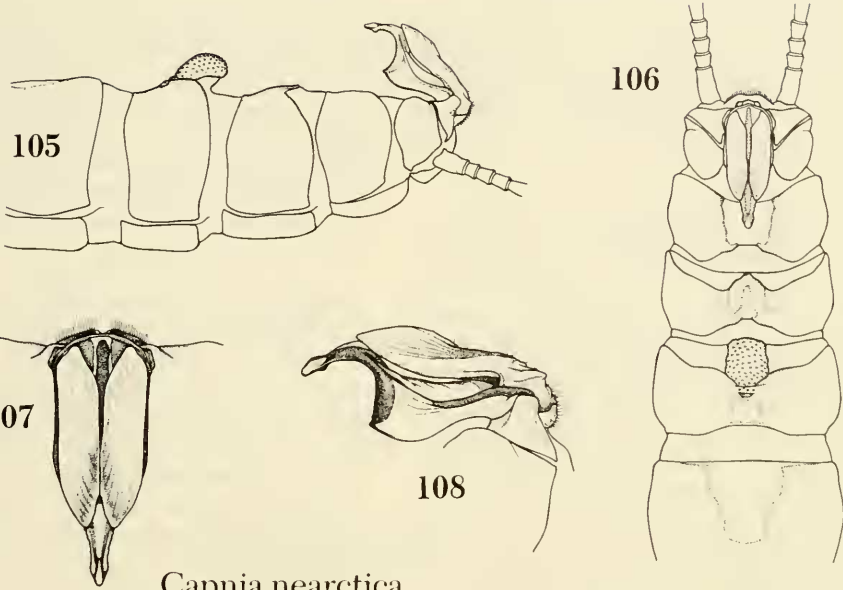
DIAGNOSIS.—The male of this species is separated from that of *C. uintahi* by the narrower lateral flange of the epiproct and from that of *C. excavata* by the undivided tergal knob on segment 8. The female of *C. cheama* has a medial notch in the posterior margin of the subgenital plate, a character shared only with the female of *C. teresa*, the range of which is farther south.

DISTRIBUTION.—ALBERTA: Athabasca River, Jasper National Park. BRITISH COLUMBIA: Fraser River, Elk River. MONTANA: Lincoln Co., Kootenai River, near Libby; (100). 14 March–1 May.

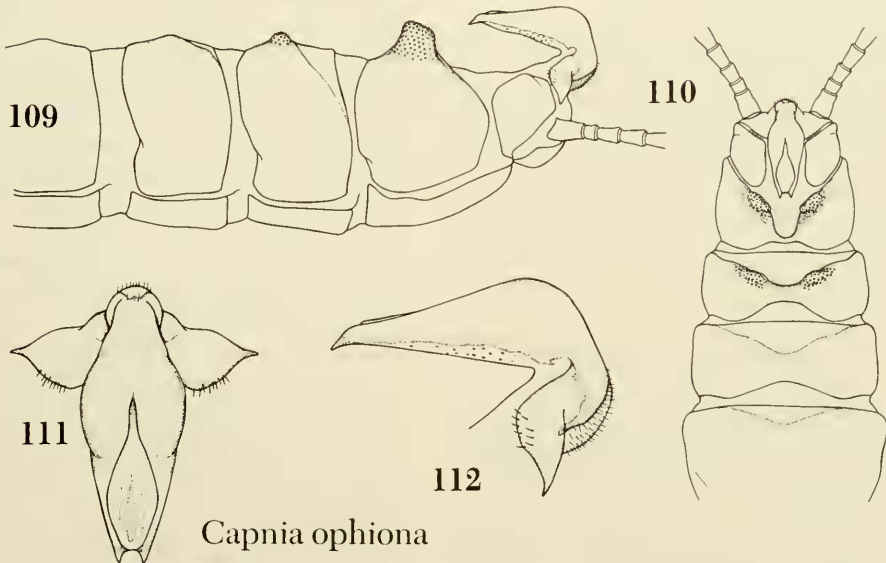
Capnia excavata Claassen

Figs. 41–44, 220, map Fig. 266

Capnia excavata Claassen 1924: 47, 1940: 93. Needham and Claassen 1925: 260. Frison 1937: 87. Ricker 1939: 21, 1943: 98, 1964: 68. Hanson 1946: 239. Jewett 1956: 170, 1959: 45, 1960: 145. Illies 1966: 137. Ricker and Scudder 1975: 339. Stark et al. 1986: 385.



Capnia nearctica



Capnia ophiona

Figs. 105–108. *Capnia nearctica* Banks: 105, male terminalia, lateral; 106, male terminalia, dorsal; 107, male epiproct, dorsal; 108, male epiproct, lateral. Northwest Territories, Keewatin District, Baffin Island, Nettilling Lake, 6 July 1956.

Figs. 109–112. *Capnia ophiona* Nelson & Baumann: 109, male terminalia, lateral; 110, male terminalia, dorsal; 111, male epiproct, dorsal; 112, male epiproct, lateral. California, Butte Co., Butte Creek, Butte Meadows Campground, 15 February 1985, R. W. Baumann and C. R. Nelson.

HOLOTYPE.—Male, California, Plumas Co., Feather River Canyon near Caribou, 24 January 1923, H. S. Barber; (USNM).

DIAGNOSIS.—This species is distinguished from others in the group by the presence of a divided tergal knob (Fig. 41) on segment 8 of the male and the darkened subgenital plate of the female, which is produced posteromedially.

DISTRIBUTION.—ALASKA: Anan Creek, southeast Wrangell, Bradfield Canal; Kowee Creek, northwest Juneau, Berners Bay; Muir Inlet. BRITISH COLUMBIA: Cameron Creek; Fraser River, Agassiz; Garibaldi Provincial Park; Harrison River at Cheheilus Indian Reserve; Nicolum River Provincial Park; Queen Charlotte Islands, Moresby Island, Browns Cabin Creek; Queen Charlotte Islands, Graham Island, Massett Inlet, Mamin River; Silverhope Creek; Vancouver Island, Courtenay and Haslom creeks (near Nanaimo); Vedder Crossing. CALIFORNIA: Butte Co.; El Dorado Co.; Humboldt Co.; Marin Co.; Mendocino Co.; Nevada Co.; Placer Co.; Plumas Co.; Shasta Co.; Sierra Co.; Siskiyou Co.; Sonoma Co.; Tehama Co.; Tuolumne Co. OREGON: Benton Co.; Clackamas Co.; Clatsop Co.; Columbia Co.; Curry Co.; Douglas Co.; Hood River Co.; Josephine Co.; Lane Co.; Linn Co.; Marion Co.; Multnomah Co.; Polk Co.; Wasco Co.; Washington Co.; Yamhill Co. WASHINGTON: Clark Co.; Cowlitz Co.; Grays Harbor Co.; Jefferson Co.; King Co.; Klickitat Co.; Lewis Co.; Pierce Co.; Skagit Co.; Skamania Co.; Wahkiakum Co.; (1645). 24 January–17 April.

Capnia uintahi Gaufin

Figs. 173–176, 251, map Fig. 266

Capnia uintahi Gaufin 1964a: 223, 1964b: 307. Gaufin et al. 1966: 49. Nebeker and Gaufin 1967a: 418, 1967b: 244, 1968: 3. Baumann and Gaufin 1971: 108. Baumann et al. 1977. Zwick 1973: 379. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Utah, Wasatch Co.; Provo River, Stewarts Ranch, 2 March 1949; (USNM).

DIAGNOSIS.—The extremely broad and flattened lateral flange on the epiproct easily distinguishes this species from all other *Capnia*. This species is most closely allied to *C. cheama*, from which it may be separated by the absence of a projection on the upper margin of the tip of the epiproct that is present in *C. cheama*. The females may be recognized as

having a pronounced notch on the anterior margin of the subgenital plate.

DISTRIBUTION.—COLORADO: Summit Co.; Cow Creek, Route 9, near mile marker 125. Green Mountain Reservoir, 9 March 1985. IDAHO: Bannock Co.; Bonneville Co.; Caribou Co.; Franklin Co.; Oneida Co. NEVADA: Elko Co.; Lander Co.; Nye Co.; White Pine Co. UTAH: Davis Co.; Salt Lake Co.; Summit Co.; Wasatch Co.; Weber Co. WYOMING: Lincoln Co.; (550). 16 February–23 August.

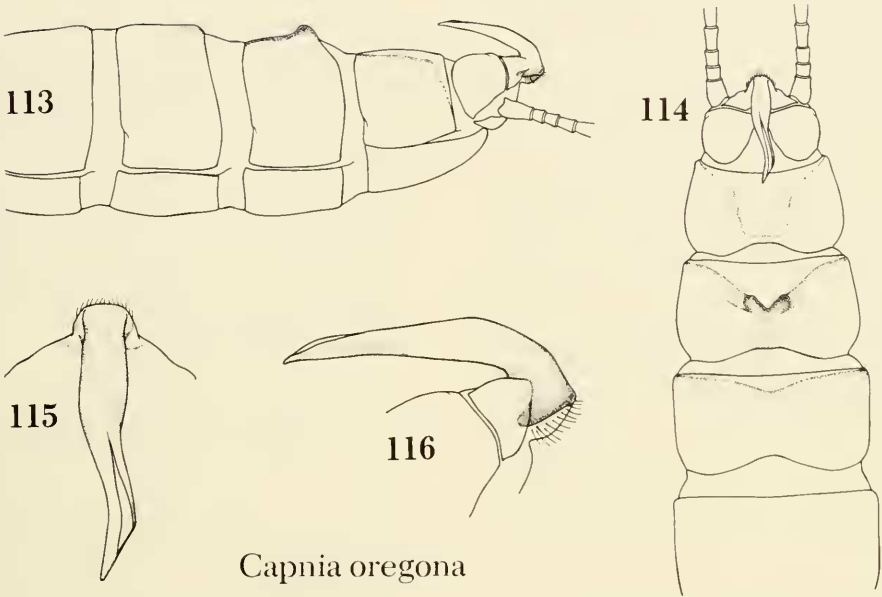
Gracilaria Group

The *C. gracilaria* group consists of four species: *Capnia elongata*, *C. gracilaria*, *C. lacustra*, and *C. promota*. These four species are united as a group by the elongate, tubelike epiproct, the presence of a tergal knob, modified to varying degrees, on abdominal segment 7, and the compoundly curved epiproct (curving upward at base and then downward before returning upward). The combination of characters of the compoundly curved epiproct and a knob on tergum 7 (except in *C. lacustra*) will differentiate the members of this group from all other North American *Capnia*. The tergal knob of *C. gracilaria* and *C. promota* is small and not significantly modified. These two species, along with *C. lacustra*, have very long curving epiprocts that should not be confused with those of other species. The genus *Mesocapnia* has an elongate epiproct, but it curves upward or is straight along the length and, in *Mesocapnia*, there are no tergal knobs. Females have a simple subgenital plate, the posterior margin of which is darkened and often tridentate.

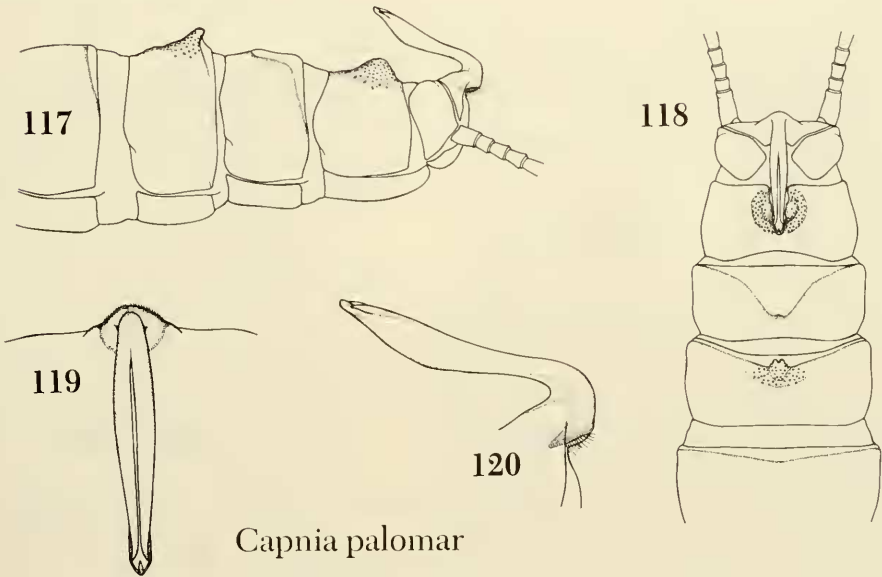
DISTRIBUTION.—This group is very widely distributed in the western United States, particularly *C. gracilaria*. Members have been collected from Baja California to Alaska and eastward to the limits of the mountains. Inland the species in this group have been collected from Alberta to New Mexico. No representatives of the group are found in the Sierra Nevada south of the Lake Tahoe region. *Capnia elongata*, *C. lacustra*, and *C. promota* are limited in distribution to the northern Sierra Nevada and the Cascades. The members of this group are often the “dominant” capniid in the streams in their range.

Key to the Males of the Gracilaria Group

1. Abdominal terga lacking knobs, epiproct with angulate bend near base in lateral view (Figs.



Capnia oregona



Capnia palomar

Figs. 113–116. *Capnia oregona* Frison: 113, male terminalia, lateral; 114, male terminalia, dorsal; 115, male epiproct, dorsal; 116, male epiproct, lateral. Oregon, Linn Co., Gordon Meadows, 4,000 feet, 18 July 1959, H. Hacker.

Figs. 117–120. *Capnia palomar* Nelson & Baumann: 117, male terminalia, lateral; 118, male terminalia, dorsal; 119, male epiproct, dorsal; 120, male epiproct, lateral. California, San Diego Co., Palomar Mountain, Fry Creek, Road S–6, Fry Creek Campground, 18 January 1985, R. W. Baumann and C. R. Nelson.

- 73, 76); inhabiting depths of Lake Tahoe *lacustra* Jewett
- Abdominal tergum 7 with modified knob; base of epiproct evenly curved, not angulate; wide-spread 2
- 2(1). Tube of epiproct of uniform height throughout length or with greatest height on distal third (lateral view, Figs. 56, 132); terga 7 and 8 both bearing small tuberculate knobs (Figs. 53, 129) 3
- Tube of epiproct with an expanded region at half its length which then tapers to a narrow tip (Fig. 40); tergum 7 bearing a large, prominent, tuberculate knob, knob not present on tergum 8 (Fig. 37) *elongata* Claassen
- 3(2). Epiproct of uniform width throughout its length (Figs. 54, 55); tip of epiproct usually not bent distinctly upward at tip (Fig. 56); ranging inland from Cascade Mountains south of British Columbia to New Mexico *gracilaria* Claassen
- Epiproct with distal one-half expanded laterally to double width of epiproct (Fig. 131); epiproct with tip always bent upward (Fig. 132); ranging more coastal, in the Cascades and Sierra Nevada *promota* Frison
- Key to the Females of the *Gracilaria* Group
1. Subgenital plate darkened throughout length, joined to sternum 7 by a sclerotized bridge that is also darkened (Fig. 219) *elongata*
- Subgenital plate with dark area limited to posterior margin; sterna 7 and 8 separated by inter-segmental membrane, not joined by a sclerotized bridge 2
- 2(1). Inhabiting depths of Lake Tahoe on border of California and Nevada (Fig. 227) *lacustra*
- Widespread 3
- 3(2). Distribution east of the Cascade Mountains in the Rocky Mountains and Great Basin (Fig. 222) *gracilaria*
- Distribution limited to streams draining the northern Cascade and Coast Ranges (Fig. 240) *promota*

NOTES.—The females of *C. gracilaria* and *C. promota* are morphologically indistinguishable, and both species have been collected in the same stream on the same day in south central Washington. The configuration of the subgenital plate of females of *C. lacustra* (Fig. 227) is within the variation seen in *C. gracilaria* and *C. promota* (Figs. 222, 240).

Capnia elongata Claassen

Figs. 37–40, 219, map Fig. 270

Capnia elongata Claassen 1924: 56, 1940: 93. Needham and Claassen 1925: 260. Ricker 1943: 99. Hanson 1946: 239. Jewett 1956: 170, 1959: 45, 1960: 145. Illies 1966: 136. Nebeker and Gaufin 1967b: 419, 1968: 3. Zwick 1973: 373. Ricker and Seudder 1975: 338. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Plumas Co., near Caribou, 24 January 1922, H. S. Barber; (USNM).

DIAGNOSIS.—The male of this species is distinguished from others in the group by the large, modified tergal knob on segment 7, the absence of a knob on tergum 8, and the tubelike epiproct, which is thick basally and tapers toward the tip. The female may be separated from others in the group by sterna 7 and 8 being joined by a broad bridge. This female may be confused with some of the females in the Barberi group in this respect but may be separated from them by its subgenital plate, which is much lighter in color.

DISTRIBUTION.—BRITISH COLUMBIA: Fraser River, Agassiz; Manquam River, tributary Squamish River; Vedder Crossing; Wahleach Creek, tributary Fraser River. CALIFORNIA: Alpine Co.; El Dorado Co.; Mariposa Co.; Nevada Co.; Placer Co.; Plumas Co.; Sierra Co.; Siskiyou Co.; Tehama Co.; Trinity Co.; Tuolumne Co. OREGON: Clackamas Co.; Jackson Co.; Linn Co.; Marion Co.; Multnomah Co. WASHINGTON: Cowlitz Co.; Lewis Co.; Pierce Co.; Skagit Co.; (1380). 18 January–14 June.

NOTES.—Hoppe (1938) described and produced a figure of a female that could fit either the female of *C. gracilaria* or *C. promota*; in any case the female described and figured by Ricker (1943) is indeed that of *C. elongata*.

Capnia gracilaria Claassen

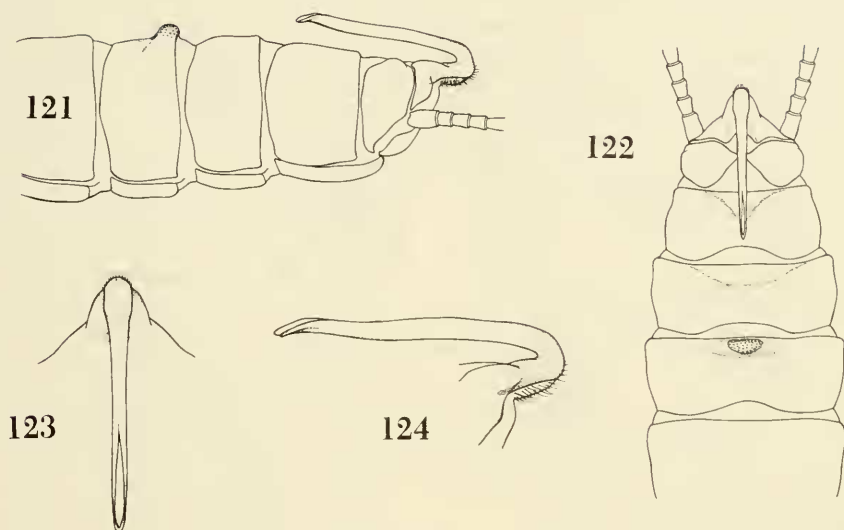
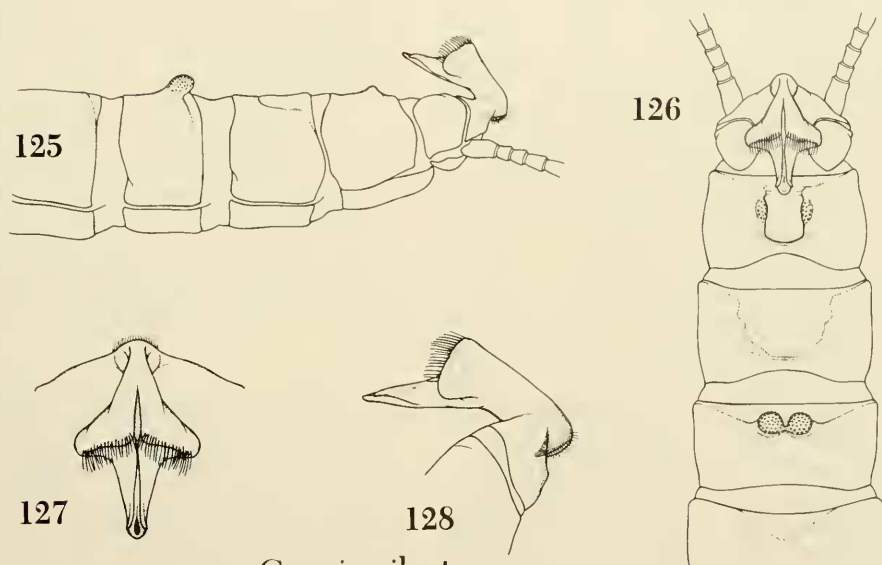
Figs. 53–56, 222, map Fig. 269

Capnia gracilaria Claassen 1924: 57, 1940: 93. Needham and Claassen 1925: 258. Ricker 1939: 21, 1943: 99. Hanson 1946: 239. Gaufin 1955: 118. Jewett 1959: 45, 1960: 145. Illies 1966: 138. Knight and Gaufin 1966: 669, 1967: 348. Nebeker and Gaufin 1966: 42, 1967b: 419, 1968: 3. Hitchcock 1969: 314. Newell 1970: 50. Nebeker 1971: 27. Zwick 1973: 373. Baumann et al. 1977: 70. Stark et al. 1986: 385.

Capnia elongata Knowlton and Harmston 1938: 284. Castle 1939: 211. Ricker 1939: 21. Gaufin 1955: 118. Gaufin et al. 1966: 46. Newell 1970: 50.

HOLOTYPE.—Male, Aweme, Manitoba, 28 April 1907, N. Criddle; (CU).

DIAGNOSIS.—The males of this widespread and common species may be confused with those of other members of the group. This species has a tubelike epiproct that is uniformly round in cross section from base to tip. The epiproct of *C. promota* is expanded laterally on the distal third so that a cross section

*Capnia petila**Capnia pileata*

Figs. 121–124. *Capnia petila* Jewett: 121, male terminalia, lateral; 122, male terminalia, dorsal; 123, male epiproct, dorsal; 124, male epiproct, lateral. Utah, Box Elder Co., Raft River Mountains, Fisher Creek, 29 March 1979, R. W. Baumann and G. M. Webb.

Figs. 125–128. *Capnia pileata* Jewett: 125, male terminalia, lateral; 126, male terminalia, dorsal; 127, male epiproct, dorsal; 128, male epiproct, lateral. Oregon, Clackamas Co., 0.6 miles north of Marquam, 15 January 1967, S. G. Jewett, Jr.

through the epiproct would produce an oval with the long axis horizontal. The epiproct of *C. elongata* is expanded in a vertical plane on its basal half; a cross section in this area would produce an oval with the long axis arranged vertically. The females have a relatively simple subgenital plate that is roughly square and darkened only along the posterior margin. The posterior margin has a short medial extension of varying length and often a pair of shorter extensions on either side of this medial tooth; these extensions are missing on some specimens, giving the impression of a smoothly rounded plate apically. The female of *C. elongata* is separated from those of this species by the fused sterna 7 and 8. The females of *C. gracilaria*, *C. lacustra*, and *C. promota* are structurally indistinguishable, except that *C. lacustra* is totally wingless. Thus, any identification of these species must be based on the male characteristics.

DISTRIBUTION.—ALASKA: Eklutna; Girdwood (near Anchorage). ALBERTA: Jasper National Park; Banff National Park. BAJA CALIFORNIA: Sierra San Pedro Martir. BRITISH COLUMBIA: Cultus Lake, Moyie River; Garibaldi Lake; Keremeos Creek; Manning Provincial Park; Penticton, Ellis Creek; Shatford Creek; Shingle Creek. CALIFORNIA: Los Angeles Co.; Modoc Co.; San Mateo Co.; Santa Clara Co.; Siskiyou Co.; Trinity Co.; Ventura Co. COLORADO: Archuleta Co.; Clear Creek Co.; Gilpin Co.; Gunnison Co.; Hinsdale Co.; Lake Co.; La Plata Co.; Larimer Co.; Las Animas Co.; Montrose Co.; Ouray Co.; Routt Co.; Summit Co. IDAHO: Ada Co.; Adams Co.; Bannock Co.; Bear Lake Co.; Blaine Co.; Boise Co.; Bonner Co.; Bonnevill Co.; Boundary Co.; Caribou Co.; Cassia Co.; Clearwater Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Jefferson Co.; Latah Co.; Lemhi Co.; Lewis Co.; Nez Pierce Co.; Shoshone Co.; Teton Co.; Twin Falls Co.; Valley Co.; Washington Co. MONTANA: Broadwater Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lewis and Clark Co.; Lincoln Co.; Meagher Co.; Missoula Co.; Park Co.; Ravalli Co.; Sanders Co. NEVADA: Elko Co.; Humboldt Co.; White Pine Co. NEW MEXICO: Colfax Co.; Grant Co.; Lincoln Co.; Sandoval Co.; San Miguel Co.; Santa Fe Co.; Taos Co. OREGON: Baker Co.; Deschutes Co.; Hood River Co.; Josephine Co.; Klamath Co.; Umatilla Co.; Union Co.;

Wallowa Co.; Wasco Co. SOUTH DAKOTA: Lawrence Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Carbon Co.; Daggett Co.; Davis Co.; Duchesne Co.; Emery Co.; Garfield Co.; Grand Co.; Iron Co.; Juab Co.; Kane Co.; Millard Co.; Morgan Co.; Piute Co.; Rich Co.; Salt Lake Co.; San Juan Co.; Sanpete Co.; Sevier Co.; Summit Co.; Tooele Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Wayne Co.; Weber Co. WASHINGTON: Asotin Co.; Garfield Co.; King Co.; Kittitas Co.; Klickitat Co.; Skamania Co.; Whitman Co.; Yakima Co. WYOMING: Albany Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.; Teton Co. YUKON TERRITORY: Christmas and Boutellier creeks, near Klunane; Klondike Highway, Moose Creek Campground; North Klondike River, Tombstone Camp; Whitehorse, Wolf Creek Campground; (3512). 26 December–14 July.

NOTE.—This species is comparatively homogeneous throughout its range, but several populations vary in structural details of the epiproct. These include the populations in both northern and southern California. As noted earlier, *C. gracilaria* and *C. promota* occur sympatrically in some streams in central Washington.

Capnia lacustra Jewett

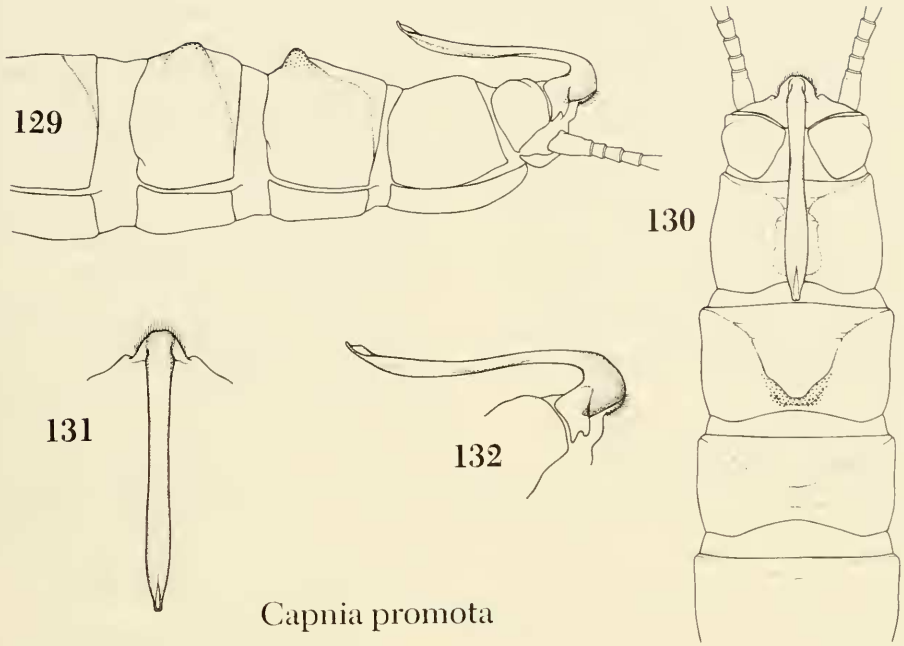
Figs. 73–76, 227, map Fig. 269

Capnia sp., Jewett 1963: 484.

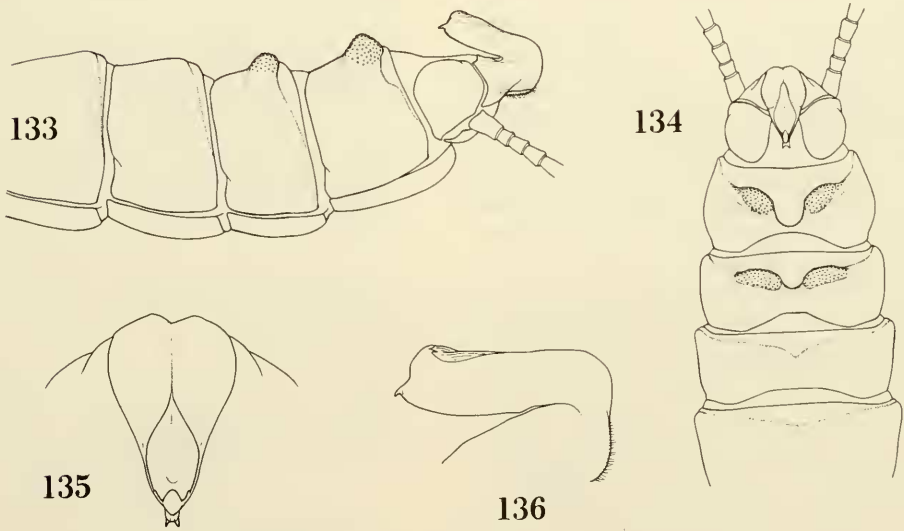
Capnia lacustra Jewett 1965: 5. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Nevada, Douglas Co., bottom of Lake Tahoe at depth of 200–264 feet off Cave Rock, 22 and 28 May 1962, Cordone, Frantz, Weedlein; (CAS).

DIAGNOSIS.—This species is totally apterous. Another very apparent way of distinguishing this species from the others in the genus is that it is caught as the adult below the surface of Lake Tahoe. The epiproct of the male is unique in having an angular projection on the upper margin of the epiproct near the base (lateral view); all other similar species of the genus have the epiproct curving evenly forward in this area. This species appears to be an extremely derived member of the *gracilaria* group as based on the long, tubelike, compoundly curved epiproct. Males lack the modified tergal knob of the other members of the group. The female has the posterior margin of the subgenital plate resembling that of *C. gracilaria* and *C. promota*.



Capnia promota



Capnia quadrituberosa

Figs. 129–132. *Capnia promota* Frison: 129, male terminalia, lateral; 130, male terminalia, dorsal; 131, male epiproct, dorsal; 132, male epiproct, lateral. Oregon, Benton Co., Corvallis, Oak Creek, 1 January 1936.

Figs. 133–136. *Capnia quadrituberosa* Hitchcock: 133, male terminalia, lateral; 134 male terminalia, dorsal; 135, male epiproct, dorsal; 136, male epiproct, lateral. California, Butte Co., small stream north of Oroville near Garden Drive, 15 February 1985, R. W. Baumann and C. R. Nelson.

DISTRIBUTION.—This species has been collected at several locations in Lake Tahoe, both in California and Nevada at depths of 100–422 feet. The specimens were obtained by dredging beds of *Chara* sp.: (32). April–December.

NOTES.—This species is the only stonefly in the world known to be fully aquatic in the adult stage. This species has not been collected again despite our intense efforts using the facilities of the University of California, Davis Research Station on Lake Tahoe. An additional species of capniid, *Utacapnia tahoensis* (Nebeker & Gaufin), is also present in Lake Tahoe and can be readily collected in substantial numbers from the rocky shores surrounding the lake.

Capnia promota Frison

Figs. 129–132, 240, map Fig. 270

Capnia promota Frison 1937: 88. Claassen 1940: 95. Hanson 1946: 239. Jewett 1956: 170, 1959: 48, 1960: 146. Illies 1966: 145. Ricker and Scudder 1975: 339. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Oregon, Benton Co., Corvallis, 23 January 1934, K. Gray; (INHS).

DIAGNOSIS.—This species is distinguished from *C. elongata* by the shorter knob on tergum 7, the presence of a small knob on tergum 8, and the epiproct lacking a distinct swelling on the basal half. This species may be separated from *C. gracilaria* by the laterally expanded epiproct, especially on the distal third. Notes on separating the females are given under *C. gracilaria*.

DISTRIBUTION.—BRITISH COLUMBIA: Vancouver Island, Millstone River, Nanaimo River. OREGON: Benton Co.; Clackamas Co.; Clatsop Co.; Columbia Co.; Coos Co.; Douglas Co.; Jackson Co.; Josephine Co.; Klamath Co.; Lane Co.; Linn Co.; Marion Co.; Multnomah Co.; Polk Co.; Wasco Co.; Washington Co.; Yamhill Co. WASHINGTON: Clark Co.; Grays Harbor Co.; King Co.; Klickitat Co.; Lewis Co.; Wahkiakum Co.; (833). 1 January–26 April.

Mariposa Group

The members of this group, *Capnia giulianii* Nelson & Baumann, *C. inyo* Nelson & Baumann, and *C. mariposa* Nelson & Baumann, are characterized by having a very prominent pair of knobs on tergum 9, which has a groove between them for the reception of the epiproct. Two of the three species have

epiproctal horns similar to those of the *decepta* and *barberi* groups; the third species seems to have lost this character secondarily. No other knobs are present on the terga, a feature, or rather a lack of feature, that differentiates them from both of the related groups, *decepta* and *barberi*. Females have a darkened subgenital plate similar to that of members of the *decepta* and *barberi* groups. The females of *C. inyo* and *C. mariposa* are inseparable. The female of *C. giulianii* is unknown, and thus a key is not given below.

DISTRIBUTION.—The group is limited in distribution to the central and southern Sierra Nevada. One species, *C. inyo*, is very common on the eastern slope of the Sierra Nevada from about Mono Lake south. A single specimen of *C. giulianii* has been collected in a stream where *C. inyo* occurs. The remaining species, *C. mariposa*, has been collected at about the same latitude, but a few specimens have been caught at several localities on the west drainages of the Sierra Nevada.

Key to the Males of the Mariposa Group

- 1. Epiproct short, less than five times as long as high (Figs. 48, 88); dorsal membranous area of epiproct bearing short, dark setae (Figs. 47, 87); lateral horns present on epiproct; epiproct not compoundly curved in lateral view 2
- Epiproct longer, 10 times as long as greatest height laterally (Fig. 68); dorsal membranous area of epiproct white, lacking distinct setae (Fig. 67); lateral horns absent; epiproct compoundly curved in lateral view
..... *inyo* Nelson & Baumann
- 2(1). Epiproct with swelling on upper and lower margins at same level, yielding a balanced bird-head-like appearance (Fig. 88); epiproct four times as long as high
..... *mariposa* Nelson & Baumann
- Epiproct with swelling on upper margin closer to apex than swelling on lower margin, epiproct five times as long as high (Fig. 48)
..... *giulianii* Nelson & Baumann

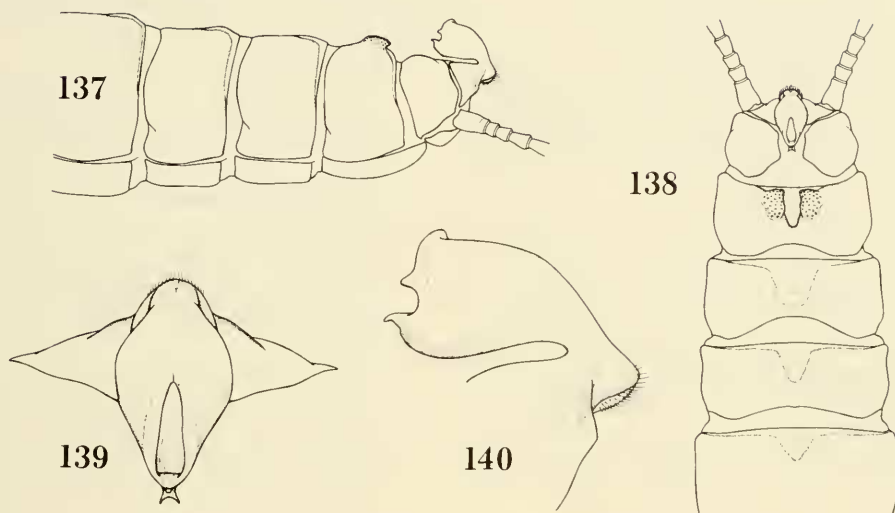
Capnia giulianii Nelson & Baumann

Figs. 45–48, map Fig. 271

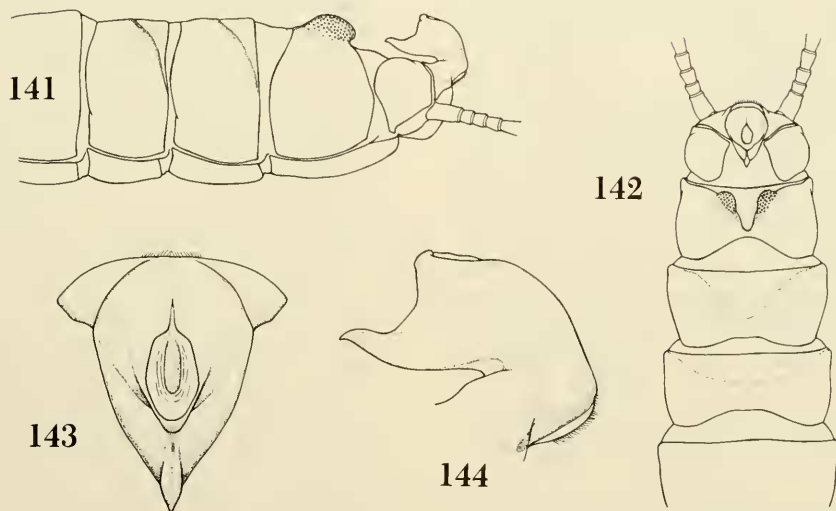
Capnia giulianii Nelson & Baumann 1987c: 499.

HOLOTYPE.—Male, California, Inyo Co., Lone Pine Creek, Whitney Portal Campground, 3 May 1981, R. W. Baumann and J. A. Stanger; (USNM).

DIAGNOSIS.—This species may be distinguished from related forms by the asymmetry of the swellings on the epiproct in lateral view (Fig. 48). The epiproct is not strongly recurved as is that of *C. inyo*.



Capnia regilla



Capnia saratoga

Figs. 137–140. *Capnia regilla* Nelson & Baumann: 137, male terminalia, lateral; 138, male terminalia, dorsal; 139, male epiproct, dorsal; 140, male epiproct, lateral. California, Marin Co., Point Reyes, 14 March 1976, D. G. Denning.

Figs. 141–144. *Capnia saratoga* Nelson & Baumann: 141, male terminalia, lateral; 142, male terminalia, dorsal; 143, male epiproct, dorsal; 144, male epiproct, lateral. California, near Saratoga, 25 February 1940, S. G. Jewett, Jr.

DISTRIBUTION.—CALIFORNIA: Inyo Co.; (1). 3 May.

Capnia inyo Nelson & Baumann

Figs. 65–68, 225, map Fig. 271

Capnia inyo Nelson & Baumann 1987c: 514.

HOLOTYPE.—Male (and female allotype), California, Inyo Co., Independence Creek, Grays Meadow Campground, 25 January 1985, R. W. Baumann and C. R. Nelson; (USNM).

DIAGNOSIS.—This is the only species of North American *Capnia* that has an elongate, compoundly curved epiproct nestled between a pair of knobs on tergum 9 (Figs. 65, 66). The female of this species is very similar and indistinguishable from that of *C. mariposa*, although the *C. mariposa* female is considerably smaller.

DISTRIBUTION.—CALIFORNIA: Inyo Co.; Mono Co.; (700). 7 December–7 May.

Capnia mariposa Nelson & Baumann

Figs. 85–88, 230, map Fig. 271

Capnia mariposa Nelson & Baumann 1987c: 501.

HOLOTYPE.—Male (and female allotype), California, Mariposa Co., Tuolumne River, Highway 120, Tuolumne Meadows Campground, 27 June 1980, R. W. Baumann and J. A. Stanger; (USNM).

DIAGNOSIS.—The male of this species is separated from others in the group, such as *C. inyo* and *C. giulianii*, on the basis of the symmetrical swelling of the midsection of the epiproct and the short epiproct, which does not reach past the anterior margin of tergum 10 in relaxed specimens. The males of this species may also be confused with *C. umpqua* but are distinguished from that species by the presence of lateral horns on the epiproct (Fig. 32).

DISTRIBUTION.—CALIFORNIA: Mariposa Co.; Tuolumne Co.; (9). 18 March–27 June.

Nana Group

The *Capnia nana* group consists of six species, *Capnia glabra* Claassen, *C. licina* Jewett, *C. melia* Frison, *C. nana* Claassen, *C. oregona* Frison, and *C. willametta* Jewett. The group is characterized by having a well-developed tergal knob on segment 8 and a compoundly curved epiproct. The females of the group often have a triangular darkened area on the posterior half of the subgenital plate.

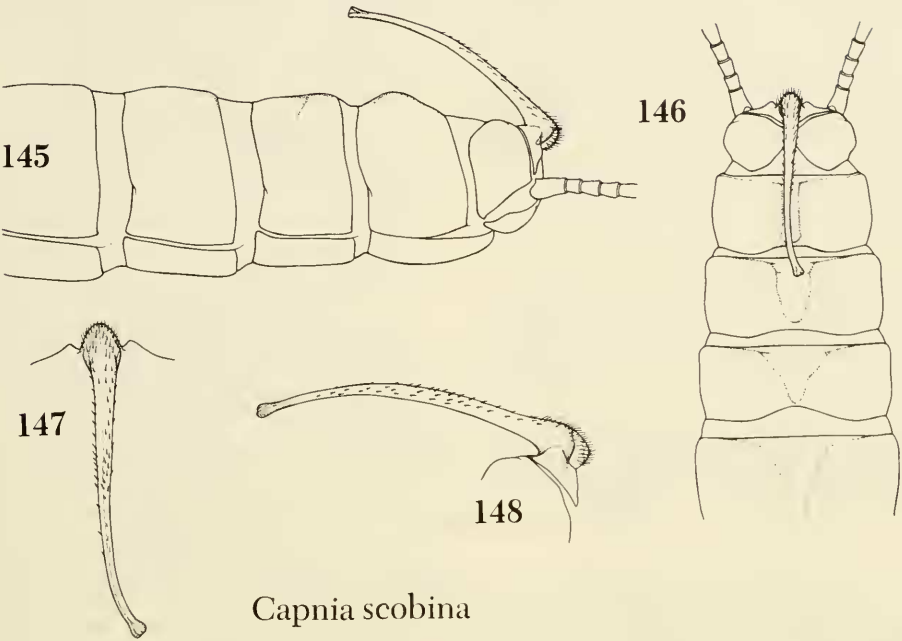
DISTRIBUTION.—Members of this group occur from British Columbia and Alberta south to the central Sierra Nevada and throughout the Rocky Mountains of Idaho and Wyoming south to Utah and Colorado.

Key to the Males of the Nana Group

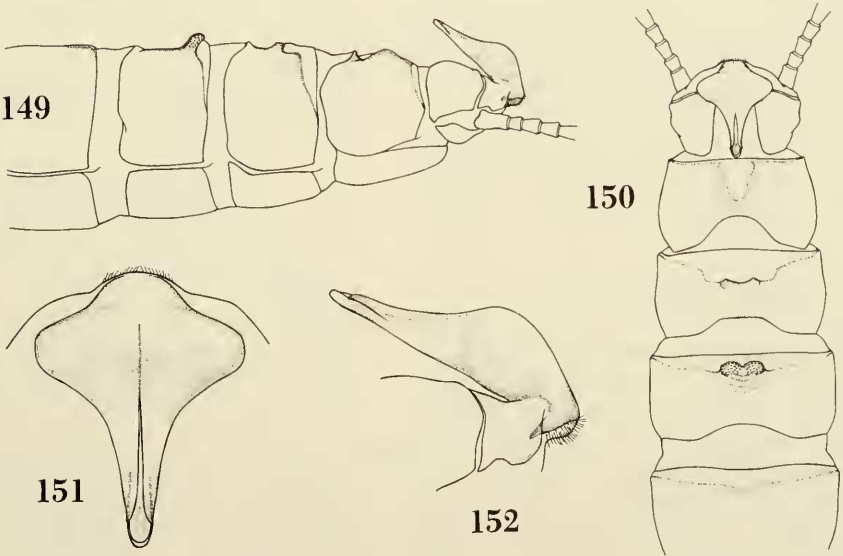
1. Epiproct with the tip bent to the left of the midline of the specimen (Figs. 51, 115) 2
- Epiproct symmetrical from dorsal view, not bent to the left of the specimen 3
- 2(1). Epiproct more than seven times as long as high in lateral view, compound curve of epiproct distinct, long, fine hairs present on lower surface of epiproct, sometimes with stout spines present on upper surface of epiproct (Figs. 51, 52) *glabra* Claassen
- Epiproct less than seven times as long as high, compound curve of epiproct not distinct with lower margin straight or arching toward tip, spines and hairs absent from shaft of epiproct although some short setae may be present (Figs. 115, 116) *oregona* Frison
- 3(1). Epiproct narrowing from base to tip in dorsal view, lacking any lateral expansion along length (Fig. 199); compound curve of epiproct indistinct, lower margin of epiproct mostly straight; spines and hairs generally absent from shaft of epiproct (Fig. 200) *willametta* Jewett
- Epiproct narrowing and then widening, moving from base to apex (Figs. 79, 91, 99, 103); compound curve of epiproct evident in lateral view; spines and hairs present or absent. 4
- 4(3). Epiproct lacking spines and hairs on shaft (Figs. 100, 104); apex of epiproct not surpassing mid-length of segment 9 in lateral view (Figs. 97, 101), barely reaching level of posterior margin of ninth tergum 9 *nana* Claassen
- Epiproct with spines and/or hairs (Figs. 80, 91, 92); apex of epiproct surpassing posterior margin of tergum 9 5
- 5(4). Epiproct with narrow lateral expansion, greatest width 1.5 times as wide as narrowest in dorsal view (Fig. 79); epiproct with long, fine hairs on lower surface (Fig. 80); upper surface of epiproct microsculptured along lateral margins (Figs. 79, 80); tergal knob on segment 7 well developed, bearing tubercles (Fig. 77) *licina* Jewett
- Epiproct with wide lateral expansion, greatest width two times as wide as narrowest in dorsal view (Fig. 91); epiproct lacking hairs on lower surface; upper surface of epiproct not microsculptured along lateral margins, but bearing a patch of spines on distal surface of lateral expansion (Fig. 91); tergal knob on segment 7 absent *melia* Frison

Key to the Females of the Nana Group
(including *C. willametta* unknown)

1. Posterior margin of subgenital plate darkly colored in a narrow band (Figs. 221, 236) 2



Capnia scobina



Capnia sequoia

Figs. 145–148. *Capnia scobina* Jewett: 145, male terminalia, lateral; 146, male terminalia, dorsal; 147, male epiproct, dorsal; 148, male epiproct, lateral. California, Nevada Co., Sagehen Creek, 6,300 feet, 15 February 1965, A. L. Sheldon.

Figs. 149–152. *Capnia sequoia* Nelson & Baumann: 149, male terminalia, lateral; 150, male terminalia, dorsal; 151, male epiproct, dorsal; 152, male epiproct, lateral. California, Tuolumne Co., Ackerson Creek, Evergreen Lodge Road, 18 March 1985, R. W. Baumann and C. R. Nelson.

- Posterior margin of subgenital plate either light or with darkly colored area extending anteriorly to cover midline of plate through at least one-third length (Figs. 228, 231, 233, 234) 3
- 2(1). Subgenital plate light colored except narrow, posterior band of dark sclerotization, any darkening of remainder of plate area internal (Fig. 221); wings hyaline, often shortened *glabra*
- Subgenital plate with a medial darkening extending anteriorly, contrasting with remainder of plate (Fig. 236); wings infuscated, never shortened *oregona*
- 3(1). Posterior margin of subgenital plate straight, not produced medially, subgenital plate bearing a triangular dark area with apex medial and arising at about midlength of plate, posterior margin with lateral notches more or less defined (Figs. 233, 234) *nana*
- Posterior margin of subgenital plate bearing a medial projection, subgenital plate without a well-defined, dark triangle, posterior margin lacking lateral notches (Figs. 228, 231)
..... *melia* and *licina*

Capnia glabra Claassen

Figs. 49–52, 221, map Fig. 272

Capnia glabra Claassen 1924: 55, 1940: 93. Needham and Claassen 1925: 258. Hanson 1946: 239. Jewett 1956: 170, 1959: 45, 1960: 145, 1966: 102. Gaufin 1964a: 223. Gaufin et al. 1966: 46. Illies 1966: 138. Nebeker and Gaufin 1967a: 419, 1968: 3. Sheldon and Jewett 1967: 4. Stark et al. 1986: 385.

HOLOTYPE.—Male, California, Plumas Co., Sunnyside Mine, 25–26 December 1922, H. S. Barber; (USNM). Female allotype, California, Nevada Co., Sagehen Creek, 6,300 feet, 9 March 1965, A. L. Sheldon; (CAS).

DIAGNOSIS.—The males of this species may be distinguished from most *Capnia* by the epiproct bending asymmetrically to the left. Two other species, *C. oregona* and *C. scobina*, also have an asymmetrical epiproct but are readily separated from *C. scobina* in having shorter epiprocts that end in narrow tips. The females of *C. glabra* have the unique darkly colored posterior margin of the subgenital plate, a character which they share only with *C. oregona*. The females of these two species may be separated by the lack of heavy coloration on the remainder of the plate in *C. glabra*, which is present in *C. oregona*. Additionally, the wings of *C. glabra* are hyaline whereas those of *C. oregona* are fumose.

DISTRIBUTION.—CALIFORNIA: Butte Co.; El Dorado Co.; Mariposa Co.; Nevada Co.; Placer Co.; Plumas Co.; Shasta Co.; Sierra Co.; Siskiyou Co.; Tehama Co.; Tuolumne

Co. IDAHO: Adams Co.; Blaine Co.; Boise Co.; Valley Co.; Washington Co. NEVADA: Washoe Co. OREGON: Baker Co.; Jackson Co.; Union Co.; (1340). 9 December–24 June.

Capnia licina Jewett

Figs. 77–80, 228, map Fig. 273

Capnia licina Jewett 1954a: 174, 1959: 46. Illies 1966: 140. Stark et al. 1986: 385. Cannings 1987: 439.

HOLOTYPE.—Male, Oregon, Clackamas Co., small creek at the junction of Highways 36 and 50, 22 April 1948, S. G. Jewett, Jr.; (USNM). Current maps show no junction of Highways 36 and 50 in Clackamas Co. Specimens of this species have been collected at the headwaters of the Salmon River about one-half mile south of the junction of Highways 26 and 35.

DIAGNOSIS.—This species can be separated from others in the group by the epiproct being symmetrical in dorsal view and by the presence of well-developed tergal knobs on segments 7 and 8. This species is also unique in having small serrulations along the dorsolateral margins of the epiproct and fine hairs on the lower surface of the epiproct. The female of this species is indistinguishable from that of *C. melia*.

DISTRIBUTION.—OREGON: Clackamas Co. WASHINGTON: Lewis Co.; Whatcom Co.; (73). 18 February–28 May.

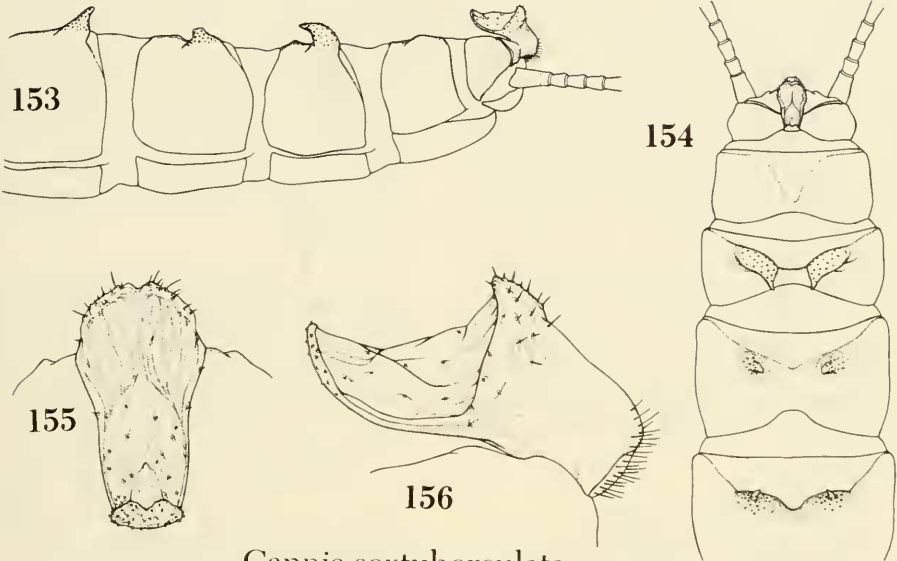
Capnia melia Frison

Figs. 89–92, 231, map Fig. 274

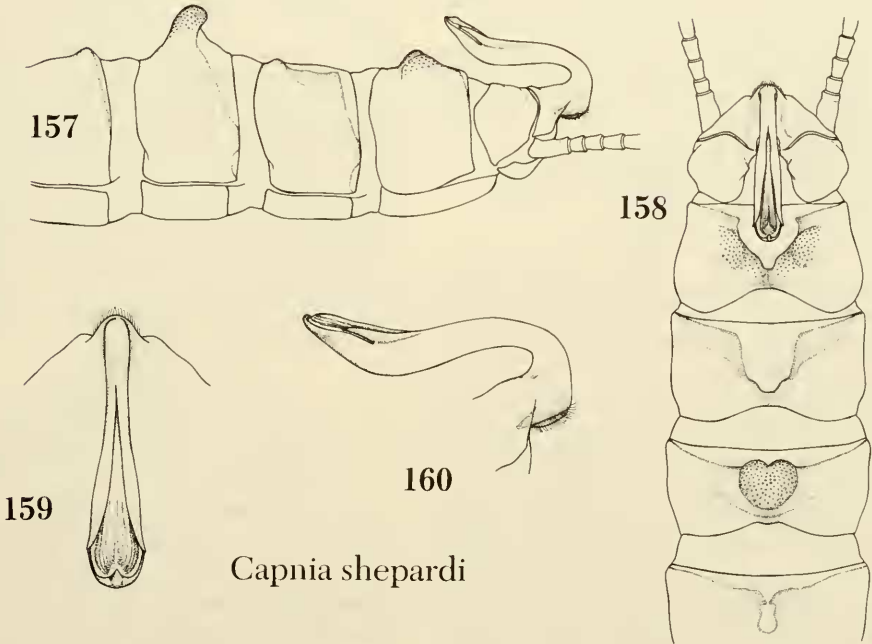
Capnia melia Frison 1942: 61. Ricker 1943: 101. Hanson 1946: 239. Jewett 1959: 47. Illies 1966: 141. Ricker and Scudder 1975: 339. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Oregon, Clackamas Co.; Wildcat Creek, tributary of Sandy River, 3 February 1939, S. G. Jewett, Jr.; (INHS).

DIAGNOSIS.—The male of this species has the epiproct widened and flattened moving from base to tip, then constricting to a pointed apex. The forward-facing portion of the expansion bears small, unsocketed spines that face anteriorly. The broad expansion and spines of the epiproct separate this species from others in the group. The females have a medial projection on the posterior margin of the subgenital plate along with a light triangle of internal sclerotization, which is visible through the plate. The presence of this medial projection should separate this species from others in the group. The plate is a pale color overall, while the often coexisting *C. excavata* has the plate



Capnia sextuberculata



Capnia shepardi

Figs. 153–156. *Capnia sextuberculata* Jewett: 153, male terminalia, lateral; 154, male terminalia, dorsal; 155, male epiproct, dorsal; 156, male epiproct, lateral. Oregon, Wallowa Co., Lake Creek, junction Lostine River, Lostine Guard Station, 19 May 1977, R. W. Baumann and D. Dunster.

Figs. 157–160. *Capnia shepardi* Nelson & Baumann: 157, male terminalia, lateral; 158, male terminalia, dorsal; 159, male epiproct, dorsal; 160, male epiproct, lateral. California, Mono Co., Lee Vining Creek, Lee Vining Campground, 14 March 1985, R. W. Baumann and C. R. Nelson.

much darkened in addition to having the posterior margin angular.

DISTRIBUTION.—ALASKA: Douglas Island. BRITISH COLUMBIA: Cultus Lake; Courtenay; Cypress Bowl Provincial Park; Garibaldi Provincial Park; Grouse Mountain Creek; Keremeos Creek; Lytton, Botanie Lake; Manning Provincial Park; Mount Arrow-smith, small creeks; Queen Charlotte Islands, Graham Island, Massett Inlet, Mamin River; Terrace. CALIFORNIA: Siskiyou Co. OREGON: Benton Co.; Clackamas Co.; Clatsop Co.; Columbia Co.; Hood River Co.; Klamath Co.; Lane Co.; Marion Co.; Multnomah Co.; Wasco Co.; Washington Co.; Yamhill Co. WASHINGTON: Clark Co.; Cowlitz Co.; King Co.; Kittitas Co.; Klickitat Co.; Pierce Co.; Skamania Co.; Snohomish Co.; (550). 8 January–27 June.

Capnia nana Claassen

Figs. 97–104, 233–234, map Fig. 275

Capnia nana Claassen 1924: 46, 1940: 94. Needham and Claassen 1925: 257. Knowlton and Harmston 1938: 284. Frison 1942: 66. Hanson 1946: 239. Gaufin 1955: 118, 1964a: 223. Jewett 1959: 47, 1966: 104. Gaufin et al. 1966: 47. Illies 1966: 142. Nebeker 1971: 27. Nebeker and Gaufin 1967a: 419, 1967c: 85, 1968: 3. Zwick 1973: 376. Ricker and Scudder 1975: 339. Baumann et al. 1977: 72. Stark et al. 1986: 385.

Capnia nana nana Nebeker & Gaufin 1967b: 239.

Capnia nana wasatchae Nebeker & Gaufin 1967b: 240. Baumann and Gaufin 1971: 108.

HOLOTYPE.—Male, Canada, British Columbia, Terrace, March 1923, Mrs. W. W. Hippiusley; (CU). Female allotype, Canada, British Columbia, Terrace, 1936, Mrs. M. E. Hippiusley; (INHS).

DIAGNOSIS.—The short, straight (dorsal view) epiproct lacking any spines or hairs differentiates the male of this species from all other males in the group. It should be noted that the epiproct expands laterally to a small extent, not, however, as much as does the epiproct of *C. melia*. The female differs from others in the group by often having lateral notches present on the posterior margin of the subgenital plate. The darkened area of the plate extends anteriorly from the posterior margin to form an indistinct triangle. This triangular area of the plate is formed from internal sclerotization that shows through the external sclerotization. *Utacapnia nedra* (Nebeker & Gaufin) superficially resembles *C. nana* but has a heavier base for the epiproct

(Nelson and Baumann 1988). The two subspecies are usually distinguished by the southern (*wasatchae*) male specimens having a stouter epiproct (Figs. 103, 104). The females of the two subspecies are not structurally distinguishable except that the northern subspecies (*nana nana*) has a slightly more delicate coloration of the subgenital plate. As noted by Nebeker and Gaufin (1967c), this species exhibits a wide variation in wing length throughout its range.

DISTRIBUTION.—ALASKA: Dewey Creek. ALBERTA: Louise Creek, Lake Louise. BRITISH COLUMBIA: Ashnola River; Lytton, Botanie Lake; Manning Provincial Park; McLeod Hill; Paulson Summit near Castlegar; Penticton, Ellis Creek; Shingle Creek; Terrace; Wells Gray Provincial Park. COLORADO: Archuleta Co.; Conejos Co.; Gunnison Co. IDAHO: Ada Co.; Adams Co.; Bannock Co.; Blaine Co.; Boise Co.; Bonneville Co.; Caribou Co.; Clearwater Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Kootenai Co.; Latah Co.; Valley Co.; Washington Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Lake Co.; Missoula Co.; Ravalli Co. OREGON: Baker Co.; Clackamas Co.; Klamath Co.; Linn Co.; Union Co.; Wallowa Co.; Washington Co.; Wheeler Co. UTAH: Box Elder Co.; Cache Co.; Carbon Co.; Davis Co.; Emery Co.; Salt Lake Co.; Summit Co.; Tooele Co.; Utah Co.; Wasatch Co.; Weber Co. WASHINGTON: Klickitat Co.; Whatcom Co. YUKON TERRITORY: Kluane, Boutellier Creek tributary; Whitehorse, Wolf Creek; (3900). 1 November–4 June.

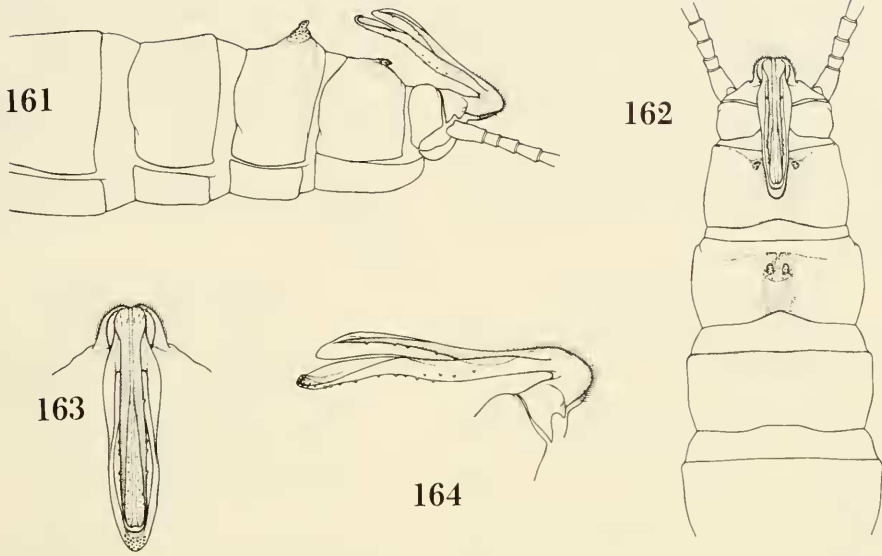
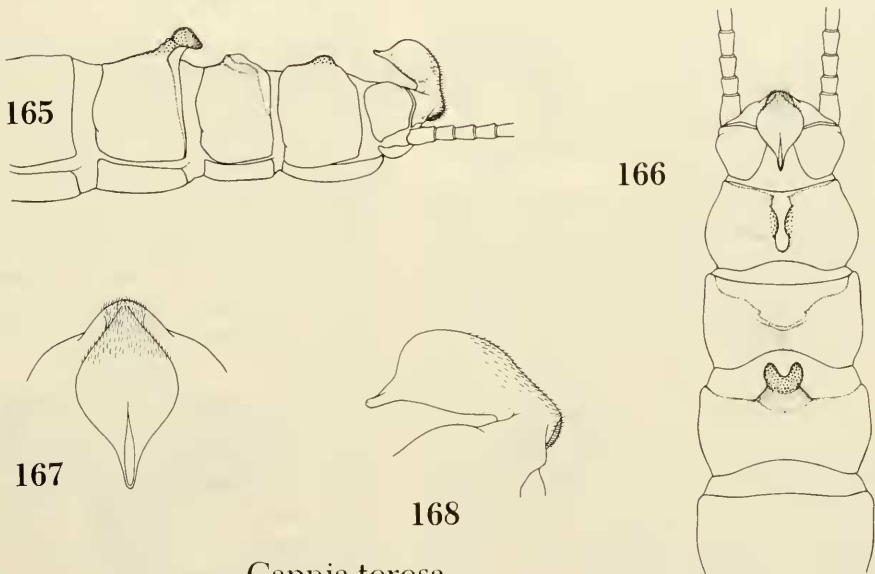
Capnia oregona Frison

Figs. 113–116, 236, map Fig. 273

Capnia oregona Frison 1942: 63. Hanson 1946: 239. Jewett 1954a: 175, 1959: 47. Illies 1966: 144. Stark et al. 1986: 385.

HOLOTYPE.—Male, Oregon, Benton Co., Muddy Creek, 14 miles south of Corvallis, 10 February 1938, S. G. Jewett, Jr.; (INHS). Female allotype, same data as holotype, described later by Jewett (1954a); (CAS).

DIAGNOSIS.—The male of this species has an epiproct which bends to the left asymmetrically and is sharply attenuated at the tip. *Capnia glabra* and *C. scobina* are similarly asymmetrical, but *C. glabra* has a somewhat longer epiproct that is blunt at the tip and *C. scobina* has a much longer epiproct, armed with dorsolateral spines and blunt at the tip.

*Capnia spinulosa**Capnia teresa*

Figs. 161–164. *Capnia spinulosa* Claassen: 161, male terminalia, lateral; 162, male terminalia, dorsal; 163, male epiproct, dorsal; 164, male epiproct, lateral. California, Los Angeles Co., San Gabriel Mountains, 0.5 miles northeast of Camp Valcrest, 24 April 1977, C. L. Hogue.

Figs. 165–168. *Capnia teresa* Claassen: 165, male terminalia, lateral; 166, male terminalia, dorsal; 167, male epiproct, dorsal; 168, male epiproct, lateral. California, San Bernardino Co., San Antonio Creek at Mount Baldy Village, 22 January 1985, R. W. Baumann and C. R. Nelson.

The female of *C. oregona* has a subgenital plate similar to that of other females in the group but can be distinguished from them by the somewhat larger body size and by the distinctly gray fumose wing color in fresh specimens, which fades to a reddish brown tinge in older, preserved specimens.

DISTRIBUTION.—OREGON: Benton Co.; Clackamas Co.; Clatsop Co.; Columbia Co.; Hood River Co.; Linn Co.; (68). 10 February–20 July.

Capnia willametta Jewett

Figs. 197–200, map Fig. 272

Capnia willametta Jewett 1955: 147, 1959: 49. Illies 1966: 150. Stark et al. 1986: 385.

HOLOTYPE.—Male, Oregon, Benton Co.; Dixon Creek, 19 January 1935, R. W. Prentiss; (INHS).

DIAGNOSIS.—The male of this species has an epiproct similar to that of *C. licina* but much flatter in lateral view. The compound curving of the epiproct is not as pronounced in *C. willametta* as in *C. licina*. The epiproct of *C. willametta* is not expanded laterally in dorsal view as in *C. licina*, nor does it bear any spines or hairs. The female is unknown. The enigmatic species *C. erecta* Jewett may be conspecific with *C. willametta*.

DISTRIBUTION.—Oregon, Benton Co.; (3). 23 January.

NOTES.—Several attempts have been made by the authors and helpful individuals to re-collect this rare species. All attempts to collect fresh specimens have failed. The holotype of this species may be an aberrant specimen of *C. erecta*, which it closely resembles.

Nearctica Group

This group of species has two members in the Nearctic region, *C. nearctica* Banks and *C. valhalla* Nelson & Baumann. Several other representatives of this group are known from the Palearctic region, including a species endemic to Lake Baikal. The inclusion of this group in *Capnia* is problematic. It could be placed in a different genus, and several have been proposed for the Palearctic species. It is beyond the scope of this article to treat the generic problems of the family Capniidae on a worldwide scale. Therefore, these species are tentatively left in *Capnia*.

The members of this group are characterized by having the epiproct consisting of two

limbs that are appressed basally, with the distal portion of the lower limb separating from the upper and arching over the abdomen. The only other North American "*Capnia*" (broad sense) with a two-limbed epiproct is *Capnia spinulosa*, which differs from *C. nearctica* and *C. valhalla* in having the two limbs closely appressed throughout the length of the epiproct. Males and females can be identified using the group key at the beginning of this article.

Capnia nearctica Banks

Figs. 105–108, 235, map Fig. 276

Capnia nearctica Banks 1918: 3. Needham and Claassen 1925: 264. Claassen 1940: 94. Ricker 1944: 178, 1954: 37, 1964: 62. Hanson 1946: 239. Weber 1950: 175. Illies 1966: 142. Ricker and Scudder 1975: 339. Stark et al. 1986: 385.

Capnia hantzchi Ricker 1935b: 173, 1944: 178. Claassen 1940: 93. Hanson 1946: 239.

HOLOTYPE.—Male, Bernard Harbour, Northwest Territories, Canadian Arctic Expedition, 25 June 1915, F. Johansen. Deposited in CNC but apparently lost, not examined by authors.

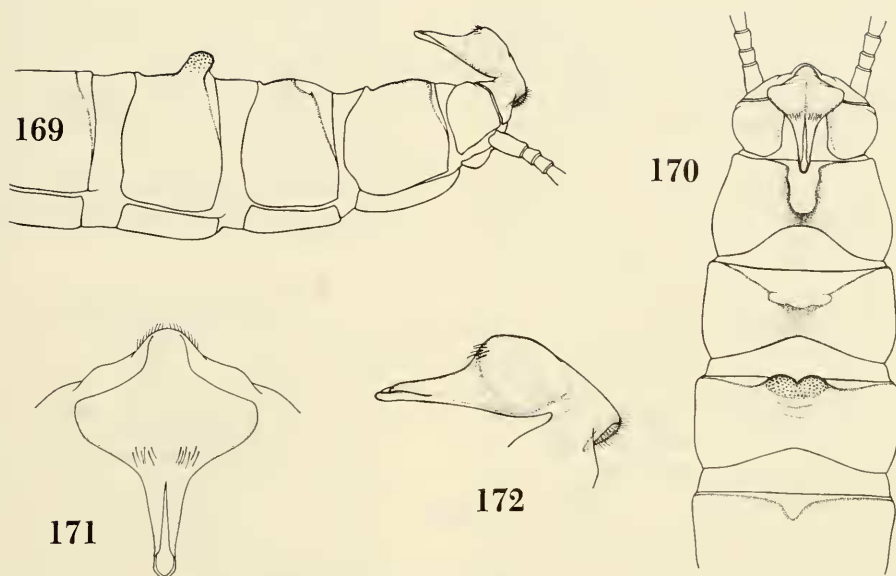
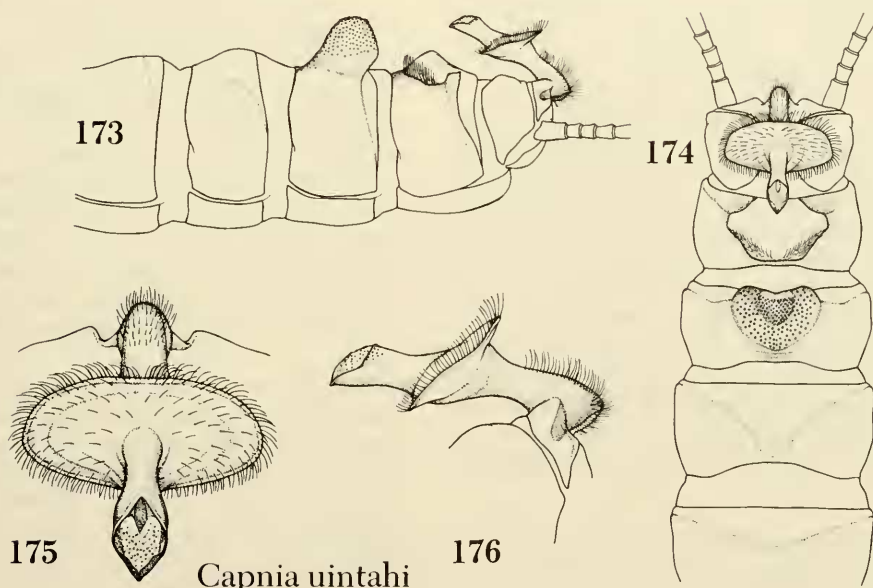
DIAGNOSIS.—The male of this species has the epiproct consisting of two limbs tightly appressed to each other throughout a major portion of their length. The distal third of the lower limb arches above the abdomen. It is closely related to *C. valhalla*, and diagnosing features are listed under that species. The females have a small, darkened subgenital plate that somewhat resembles that of several *Utacapnia* species. This resemblance may indicate a phylogenetic relationship between these taxa.

DISTRIBUTION.—ALASKA: Anaktuvuk Pass; Joolik Lake; Kikitaliorak Lake; Meade River; Noatak River, Feniak Lake; Oilspill Lake. BRITISH COLUMBIA: Atlin. NORTHWEST TERRITORIES: Keewatin District: Armark River, 30 miles upriver; Baffin Island; Baker Lake, Chesterfield Inlet; Great Slave Lake; Nettilling Lake. Mackenzie District: Arlone Lake; Bernard Harbour; Coppermine River mouth; Great Bear Lake, Echo Bay (Port Radium); Lake MacAlpine. YUKON TERRITORY: Alligator Lake; Horseshoe Bay Campground; Ogilvie Mountains. (63). 3 June–26 July.

Capnia valhalla Nelson & Baumann

Figs. 185–188, 254, map Fig. 276

Capnia valhalla Nelson & Baumann 1987c: 510.

*Capnia tumida**Capnia uintahi*

Figs. 169–172. *Capnia tumida* Claassen: 169, male terminalia, lateral; 170, male terminalia, dorsal; 171, male epiproct, dorsal; 172, male epiproct, lateral. California, Plumas Co., Mosquito Creek at junction North Fork Feather River, 14 February 1985, R. W. Baumann and C. R. Nelson.

Figs. 173–176. *Capnia uintahi* Gaufin: 173, male terminalia, lateral; 174, male terminalia, dorsal; 175, male epiproct, dorsal; 176, male epiproct, lateral. Utah, Wasatch Co., Provo River, Stewarts Ranch, 2 March 1949, A. R. Gaufin.

HOLOTYPE.—Male, California, San Diego Co., Palomar Mountain, Fry Creek, Fry Creek Campground, road S-6, 18 January 1985, R. W. Baumann and C. R. Nelson; (USNM). Female allotype, Los Angeles Co., San Gabriel Mountains, 0.5 miles east of Horseflat Road, 6 March 1977, C. L. Hogue, no. 229; (LACM).

DIAGNOSIS.—The male of this species is distinct among *Capnia* in having a two-limbed epiproct. This species can be separated from *C. spinulosa* by the widely separated limbs of the epiproct, which arch freely over part of the epiproctal length. This species is most closely related to *C. nearctica*, from which it may be distinguished by the basal narrowing of the epiproct and the longer arched portion of the lower limb in *C. valhalla*. These two species may be further separated by the more extensive tergal knobs in *C. valhalla*. The female can be separated from all others in the genus except *C. uintahi* by the notch on the anterior margin of the subgenital plate and from *C. uintahi* by the darkened triangle on the plate.

DISTRIBUTION.—CALIFORNIA: Los Angeles Co.; San Diego Co.; (12). 18 January–31 March.

Vernalis Group

The *C. vernalis* group consists of three species, *C. confusa* Claassen, *C. lineata* Hanson, and *C. vernalis* Newport. The members of the group are united by the synapomorphic character of a medial bridge or bridge vestige between the abdominal sternites 7 and 8 of the female. The epiproct of the male is produced as a simple tube with little modification. The abdominal tergites of the males are without knobs. All three species emerge late in the seasonal succession of capniids, with *C. confusa* generally being the last capniid species to disappear during the spring and summer months.

Key to the Males of the Vernalis Group

1. Epiproct of uniform width through length when viewed laterally 2
- Epiproct narrowed on distal third to about one-half width at base (Fig. 196) *vernalis* Newport
- 2(1). Epiproct reaching anterior margin of tergum 9 (Fig. 82), brachypterous, in streams of Latah County, Idaho *lineata* Hanson
- Epiproct not reaching anterior margin of tergum 9 (Fig. 25), wings usually long (somewhat shortened in lake-dwelling forms), widespread in distribution *confusa* Claassen

Key to the Females of the Vernalis Group

1. Medial bridge between sternites 7 and 8 complete (Fig. 256) *vernalis*
- Medial bridge between sternites 7 and 8 interrupted 2
- 2(1). Medial bridge reduced to two small, irregular sclerites imbedded in intersegmental membrane (Fig. 229) *lineata*
- Medial bridge represented by hind margin of sternite 7 projecting posteriorly into intersegmental membrane, but separated from sternite 8 by membrane (Fig. 216) *confusa*

Capnia confusa Claassen

Figs. 25–28, 216, map Fig. 277

Capnia nivalis Neave 1929: 163 (preoccupied by Ueno 1929: 143).

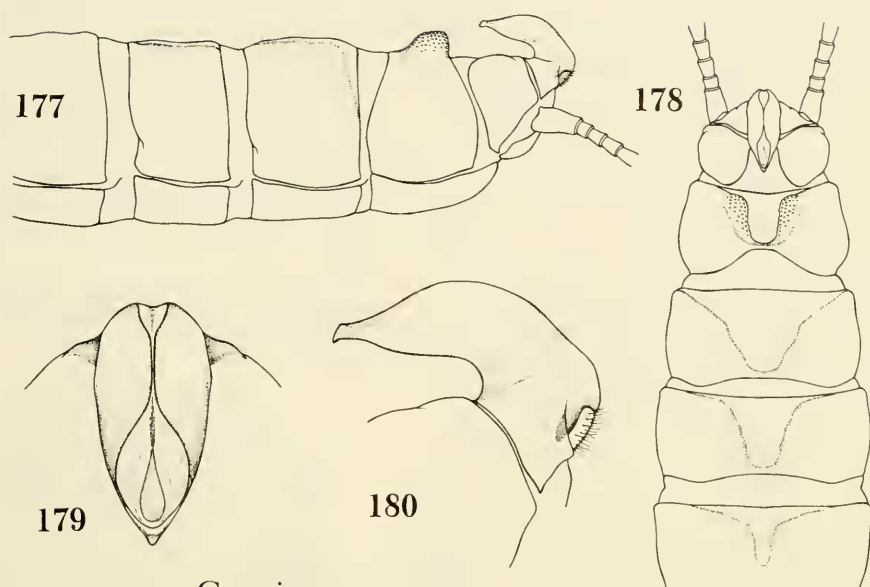
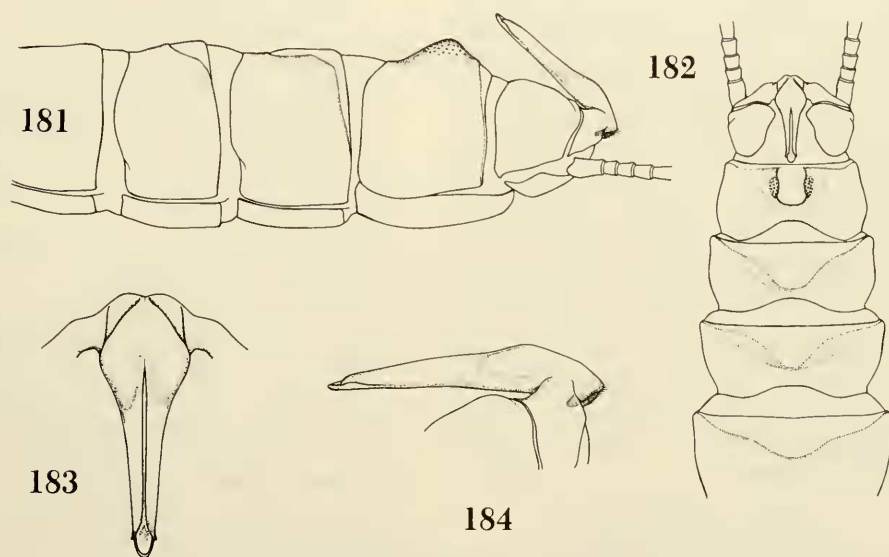
Capnia confusa Claassen 1936: 623, 1940: 92. Ricker 1943: 102, 1964: 61. Hanson 1946: 238. Weber 1950: 175. Gaufin 1955: 118, 1964a: 223. Jewett 1959: 43, 1962: 15. Gaufin et al. 1966: 45, 1972: 66. Illies 1966: 135. Nebeker and Gaufin 1966: 42, 1967a: 419, 1968: 2. Hitchcock 1969: 314. Newell 1970: 50. Baumann and Gaufin 1971: 108. Nebeker 1971: 27. Radford and Hartland-Rowe 1971: 660. Zwick 1973: 372. Ricker and Scudder 1975: 338. Baumann et al. 1977: 68. Dosdall and Lemkuhl 1979: 28. Donald and Anderson 1980: 756. Flannagan and Flannagan 1982: 23. Jacobi and Baumann 1983: 586. Donald and Patriquin 1983: 921. Stark et al. 1986: 385.

Capnia ligatula Hanson 1943a: 85. Illies 1966: 140.

HOLOTYPE.—Male (and female allotype), Maligne Lake, Jasper National Park, Alberta, no repository listed, not examined.

DIAGNOSIS.—This species is separated from related species on the basis of the somewhat shorter epiproct of the male, which is not narrowed toward the apex. The females are unique in having a medial projection of dark sclerotization on the posterior margin of sternum 7.

DISTRIBUTION.—This is probably the most widespread member of the genus in North America. ALASKA: Anuktuwuk; Chena River, Monument Creek; Chugach Mountains; Echootka River; Katmai National Park; Ketchikan, 15 miles north; Kodiak Island; Ugashik Lake. ALBERTA: Jasper National Park, Maligne Lake; Athabasca River; Banff National Park, Spray River. ARIZONA: Apache Co.; Graham Co. BRITISH COLUMBIA: Atlin; Bromley Provincial Park; Charlie Lake; Cheakamus River; Cultus Lake; Elk River; Fraser River, Agassiz; Glacier Park; Kere-meos Creek; Lake Lisadele; Meadow Creek Highway 3; Moosehorn Lake; Moyie River below Cultus Lake; Pine River, Lemoray;

*Capnia umpqua**Capnia utahensis*

Figs. 177–180. *Capnia umpqua* Frison: 177, male terminalia, lateral; 178, male terminalia, dorsal; 179, male epiproct, dorsal; 180, male epiproct, lateral. California, Shasta Co., Sulphur Creek, Castle Crags State Park, 16 February 1985, R. W. Baumann and C. R. Nelson.

Figs. 181–184. *Capnia utahensis* Gaufin & Jewett: 181, male terminalia, lateral; 182, male terminalia, dorsal; 183, male epiproct, dorsal; 184, male epiproct, lateral. Utah, Beaver Co., South Creek, 0.5 mile south of Beaver, 21 February 1965, A. V. Nebeker.

Salmo, southwest on Highway 3; Similkameen River; Stoney Creek; Sumas River; Vedder Crossing. CALIFORNIA: Alpine Co.; Mono Co. COLORADO: Boulder Co.; Chaffee Co.; Clear Creek Co.; Conejos Co.; Dolores Co.; Eagle Co.; El Paso Co.; Garfield Co.; Grande Co.; Gunnison Co.; Hinsdale Co.; Huerfano Co.; Jackson Co.; Jefferson Co.; La Plata Co.; Larimer Co.; Montezuma Co.; Ouray Co.; Pitkin Co.; Routt Co.; San Miguel Co.; Summit Co.; Teller Co. IDAHO: Adams Co.; Bannock Co.; Bear Lake Co.; Benewah Co.; Blaine Co.; Boise Co.; Bonneville Co.; Butte Co.; Custer Co.; Franklin Co.; Fremont Co.; Idaho Co.; Latah Co.; Lemhi Co.; Shoshone Co.; Twin Falls Co.; Valley Co. MANITOBA: Crawford Creek; Little Ochre River; Neepawa Creek; South Duck River. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Glacier Co.; Granite Co.; Lake Co.; Lincoln Co.; Mineral Co.; Missoula Co.; Park Co.; Ravalli Co.; Sanders Co. NEVADA: White Pine Co. NEW MEXICO: Colfax Co.; Lincoln Co.; Rio Arriba Co.; Sandoval Co.; San Miguel Co.; Taos Co. OREGON: Baker Co.; Union Co.; Wallowa Co. SOUTH DAKOTA: Lawrence Co. UTAH: Beaver Co.; Box Elder Co.; Cache Co.; Carbon Co.; Daggett Co.; Emery Co.; Garfield Co.; Grand Co.; Iron Co.; Millard Co.; Morgan Co.; Piute Co.; Salt Lake Co.; San Juan Co.; Sanpete Co.; Sevier Co.; Summit Co.; Uintah Co.; Utah Co.; Wasatch Co.; Washington Co.; Weber Co. WASHINGTON: Clallam Co.; Jefferson Co.; Kittitas Co.; Klickitat Co.; Pierce Co. WYOMING: Fremont Co.; Lincoln Co.; Park Co.; Platte Co.; Sublette Co.; Teton Co. YUKON TERRITORY: Alaska Highway, Horseshoe Bay Campground; Dempster Highway, km 142; North Fork Pass, Ogilvie Mountains; (3300). 4 January–6 August.

Capnia lineata Hanson

Figs. 81–84, 229, map Fig. 278

Capnia lineata Hanson 1943: 85, 1946: 239. Jewett 1959: 47. Illies 1966: 140. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), Idaho, Latah Co., Troy, 22 April 1911; (Hanson Collection; USNM; on slide).

DIAGNOSIS.—The male of this species most closely resembles that of *C. confusa*; the two are distinguished on the basis of the relatively longer epiproct of *C. lineata*. The females of these two species are separated by the pres-

ence of vestiges of a sclerotized bridge between sternites 7 and 8 of *C. lineata*, which are represented by variably shaped small sclerites imbedded in the medial membrane between the two sterna as opposed to the posteriorly projecting medial margin of sternum 7 in *C. confusa*. All examined male specimens of *C. lineata* have been short-winged, while those of the other two species in the group are longer winged. This species is often collected with *C. zukeli* Hanson and *Capnura venosa* Banks.

DISTRIBUTION.—IDAHO: Latah Co.; several creeks in the Troy area; (125). 24 February–28 June.

Capnia vernalis Newport

Figs. 193–196, 256, map Fig. 278

Capnia vernalis Newport 1848: 388, 1851: 451. Sharp 1895: 395. Needham and Claassen 1925: 256. Claassen 1931: 109, 1940: 95. Ricker 1938: 135, 1944: 178, 1946: 55, 1964: 55. Essig 1942: 147. Harden and Mickel 1952: 24. Gaufin 1956: 323 (*Paracapnia*?). Brinck 1958: 53. Illies 1966: 149. Nebeker and Gaufin 1967b: 419, 1968: 3. Ricker et al. 1968: 1110. Kimmins 1970: 352. Zwick 1973: 380. Ricker and Scudder 1975: 339. Baumann et al. 1977: 74. Stark et al. 1986: 385.

Nemoura tenuis Walker 1852: 182.

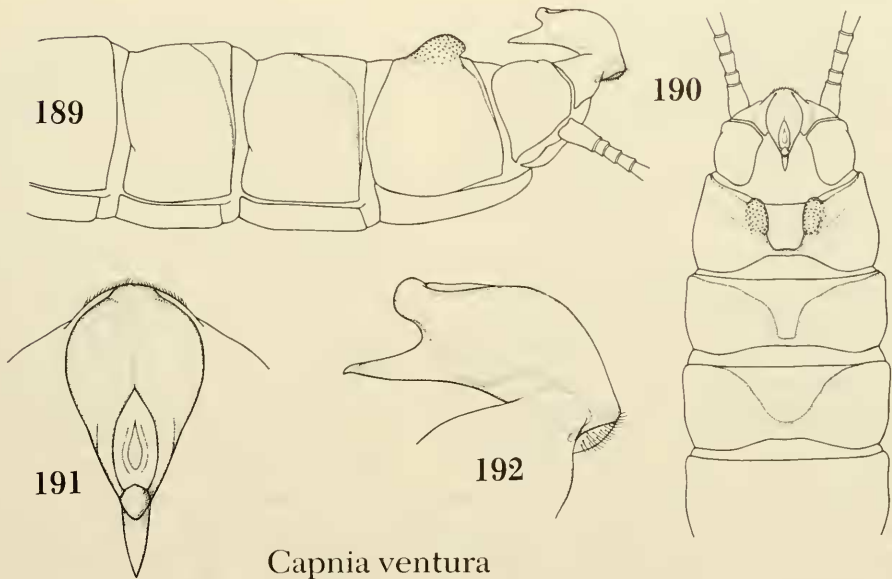
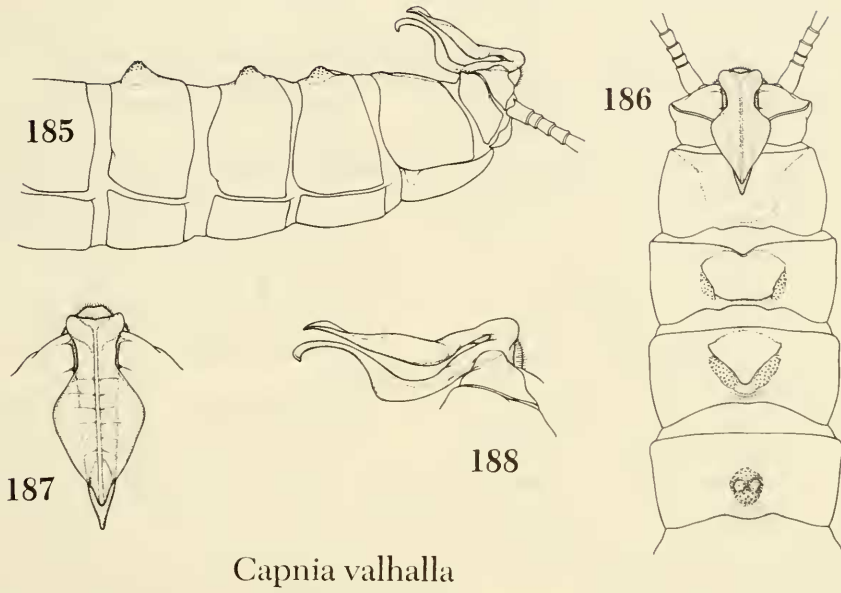
Capnia limata Frison 1944: 155. Hanson 1946: 239. Gaufin 1964a: 223. Ricker 1964: 55. Gaufin et al. 1966: 47. Illies 1966: 140. Nebeker and Gaufin 1967a: 419, 1967b: 247, 1968: 3. Newell 1970: 50. Zwick 1973: 374.

Capnia limata [sic] Gaufin 1955: 118. Knight and Gaufin 1966: 669, 1967: 348.

HOLOTYPE.—Male, Canada, Ontario, Albany River; (British Museum).

DIAGNOSIS.—Males of this species are readily distinguished from the other two species in the group by the narrowing on the distal third of the epiproct. Females of this species have a narrow bridge of sclerotization joining sternites 7 and 8; vestiges of this bridge are present in *C. lineata* and *C. confusa* but never to the extent that the sclerotization crosses the intersegmental membrane. *Capnia vernalis* has the most eastern distribution for species in North America.

DISTRIBUTION.—ALASKA: West Fork Chena River. ALBERTA: Banff National Park, Athabasca River; Edmonton; Lethbridge; McLeod River; Medicine Hat; Oldman River; Saskatchewan River. BRITISH COLUMBIA: Fraser River, Agassiz. COLORADO: Arapahoe Co.; Archuleta Co.; Chaffee Co.; Conejos Co.; Douglas Co.; Grand Co.; Gunnison Co.;



Figs. 185–188. *Capnia valhalla* Nelson & Baumann: 185, male terminalia, lateral; 186, male terminalia, dorsal; 187, male epiproct, dorsal; 188, male epiproct, lateral. California, San Diego Co., Palomar Mountain, Fry Creek, Road S–6, Fry Creek Campground, 18 January 1985, R. W. Baumann and C. R. Nelson.

Figs. 189–192. *Capnia ventura* Nelson & Baumann: 189, male terminalia, lateral; 190, male terminalia, dorsal; 191, male epiproct, dorsal; 192, male epiproct, lateral. California, Ventura Co., Bear Creek, Wheeler Gorge Campground north of Ojai, 23 January 1985, R. W. Baumann and C. R. Nelson.

Jackson Co.; Jefferson Co.; Moffat Co.; Montrose Co.; Pueblo Co.; Routt Co. IDAHO: Benewah Co.; Blaine Co.; Cassia Co.; Power Co. MINNESOTA: Lake Co.; Stewart River; St. Louis Co.; Duluth. MONTANA: Broadwater Co.; Cascade Co.; Custer Co.; Gallatin Co.; Madison Co. NEVADA: Elko Co. NEWFOUNDLAND: Anatalak Bay, Nain. NEW MEXICO: Colfax Co.; Rio Arriba Co. NORTHWEST TERRITORIES: Escarpment Creek at Mackenzie Highway. ONTARIO: Hudson Bay, Winisk River at Winisk. OREGON: Harney Co.; Malheur Co. QUEBEC: Bonaventure Co.; Charlevoix Co.; Chicoutimi Co.; Gaspé Co.; Lake St. John Co.; Matane Co.; Montmagny Co.; Montmorency Co.; Portneuf Co.; Saguenay Co.; Ungava Co. SASKATCHEWAN: Saskatoon. UTAH: Box Elder Co.; Cache Co.; Duchesne Co.; Garfield Co.; Grand Co.; Sevier Co.; Summit Co.; Uintah Co.; Utah Co. WYOMING: Albany Co.; Carbon Co.; Lincoln Co.; Platte Co.; Sublette Co.; Uintah Co.; (520). 7 February–8 July.

Species of Uncertain Group Status

Capnia scobina Jewett

Figs. 145–148, 244, map Fig. 279

Capnia scobina Jewett 1966: 105. Nebeker and Gaufin 1967a: 415. Sheldon and Jewett 1967: 4. Zwick 1973: 378. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), California, Nevada Co., Sagehen Creek, 6,300 feet elevation, 15 February 1965, A. L. Sheldon; (CAS).

DIAGNOSIS.—The asymmetrical bending of the male epiproct in dorsal view separates this species from all other North American *Capnia* except *C. glabra* and *C. oregona*. This species may be distinguished from the latter two by the much longer and thinner epiproct, which arches simply over the dorsum of the abdomen rather than having a compound curve along its length. The subgenital plate of the female is simple and not heavily sclerotized. The posterior margin of the subgenital plate is recessed anterior to the end of the segment.

DISTRIBUTION.—CALIFORNIA: Alpine Co.; El Dorado Co.; Inyo Co.; Mariposa Co.; Nevada Co.; Placer Co.; Sierra Co. NEVADA: Washoe Co.; (3585). 28 December–13 May.

Capnia sextuberculata Jewett

Figs. 153–156, 246, map Fig. 279

Capnia sextuberculata Jewett 1954: 547, 1959: 48. Illies 1966: 146. Nebeker and Gaufin 1967a: 418, 1967b:

239, 1968: 3. Newell 1970: 50. Baumann et al. 1977: 73. Stark et al. 1986: 385.

HOLOTYPE.—Male, Oregon, Baker Co., Spring Creek, tributary of Powder River, 23 March 1952, J. H. Baker; (CAS).

DIAGNOSIS.—The three pairs of pointed tergal knobs present on the abdomen distinguish this species from all others in the genus. The extremely short and membranous epiproct is also unique. This species is very small and the males are brachypterous. The small size of the female, along with the subgenital plate that has an hourglass shape of sclerotization, should differentiate this species from all others.

DISTRIBUTION.—ALBERTA: Banff National Park. BRITISH COLUMBIA: Lytton, Botanie Lake. IDAHO: Adams Co.; Boise Co.; Caribou Co.; Valley Co. MONTANA: Cascade Co.; Flathead Co.; Gallatin Co.; Lake Co.; Missoula Co.; Stillwater Co. OREGON: Baker Co.; Wallowa Co. WASHINGTON: Chelan Co.; Pierce Co.; Whatcom Co. WYOMING: Teton Co.; (300). 6 March–9 June.

Capnia spinulosa Claassen

Figs. 161–164, 248, map Fig. 279

Capnia spinulosa Claassen 1937: 80, 1940: 95. Hanson 1946: 239. Jewett 1956: 169, 1960: 146. Illies 1966: 147. Stark et al. 1986: 385.

HOLOTYPE.—Male (and female allotype), southern California; (CU).

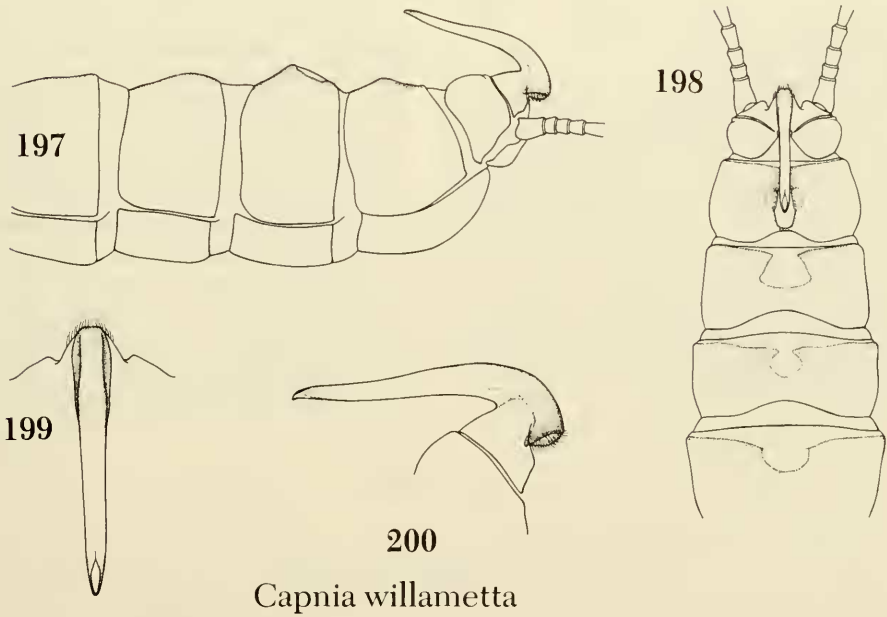
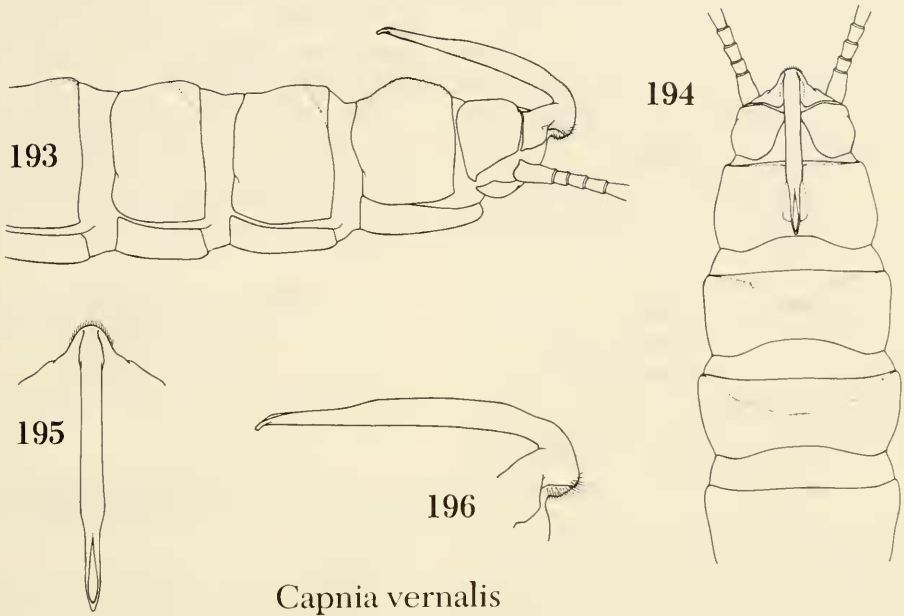
DIAGNOSIS.—The presence of paired tergal projections and the two-limbed epiproct will separate this species from most others in the genus *Capnia*. The females may be distinguished from others in the genus on the basis of the narrow, dark, sclerotized subgenital plate that extends from the anterior margin to the posterior margin of sternum 8.

DISTRIBUTION.—CALIFORNIA: Los Angeles Co.; San Gabriel Mountains; 0.5 miles north-east of Camp Valcrest; San Gabriel Mountains; 0.5 miles east of Horseflats; Placerita Canyon Creek, Placerita Canyon State Park. Riverside Co., P. L. Boyd Desert Research Center, 3.5 miles south of Palm Desert; (25). 21 January–24 April.

Capnia zukeli Hanson

Figs. 205–208, 258, map Fig. 279

Capnia zukeli Hanson 1943a: 86. Jewett 1959: 49. Illies 1966: 151. Baumann et al. 1977: 72 (in part). Stark et al. 1986: 385.



Figs. 193–196. *Capnia vernalis* Newport: 193, male terminalia, lateral; 194, male terminalia, dorsal; 195, male epiproct, dorsal; 196, male epiproct, lateral. Montana, Broadwater Co., Missouri River, Toston, 28 March 1952, R. Hays.

Figs. 197–200. *Capnia willametta* Jewett: 197, male terminalia, lateral; 198, male terminalia, dorsal; 199, male epiproct, dorsal; 200, male epiproct, lateral. Oregon, Benton Co., Dixon Creek, Corvallis, 23 January 1935, R. W. Prentiss.

HOLOTYPE.—Male (and female allotype), Idaho, Latah Co., Moscow, 2,560 feet, 2 April 1938, Zukel; (USNM).

DIAGNOSIS.—The extremely long epiproct (30 times as long as wide), the absence of tergal knobs, and brachyptery distinguish this species from all others in the genus. Baumann et al. (1977) synonymized this species with *C. lineata*, based on limited material. Further collecting and careful examination of the types showed two distinct forms of both males and females in the material from Latah Co., Idaho. Each of the two species names available (*C. lineata* and *C. zukeli*) is referable to one of these forms. The illustrations given in the original descriptions are representative of each of the species. The descriptions and figures given for the female of this species and *C. lineata* by Hanson (1943a) are ambiguous and fail to separate the females of the two species. Hanson most likely described the females of both species from material of one of the species, probably *C. zukeli*. Proper associations have now been made using material collected in the absence of the other species. The following description of the female of *C. zukeli* is based on that material:

DESCRIPTION.—Female body length 9.0 mm, macropterous, length of forewing 7.8 mm, subgenital plate with hind margin straight and recessed, muscle insertions lateral from posterior margin darkly colored, small, spurious sclerites absent from membrane between sterna 7 and 8.

MATERIAL.—Female, Idaho, Latah Co., Little Boulder Creek at Little Boulder Creek Campground, 26 April 1985, R. W. Baumann and C. R. Nelson; (BYU).

DISTRIBUTION.—IDAHO: Latah Co.: Potlatch River, Moscow Mt. 3,500–4,800 feet, Palouse River, Troy Creek, Spring Valley Creek near reservoir, Little Boulder Creek; (176). 1 April–12 May.

NOTES.—This unusual species lives in the same area as several other endemic capniids, *Capnura venosa* and *Capnia lineata*. This species resembles the latter of these two species but seems to be distinct from it in both sexes.

Species of Uncertain Taxonomic Status

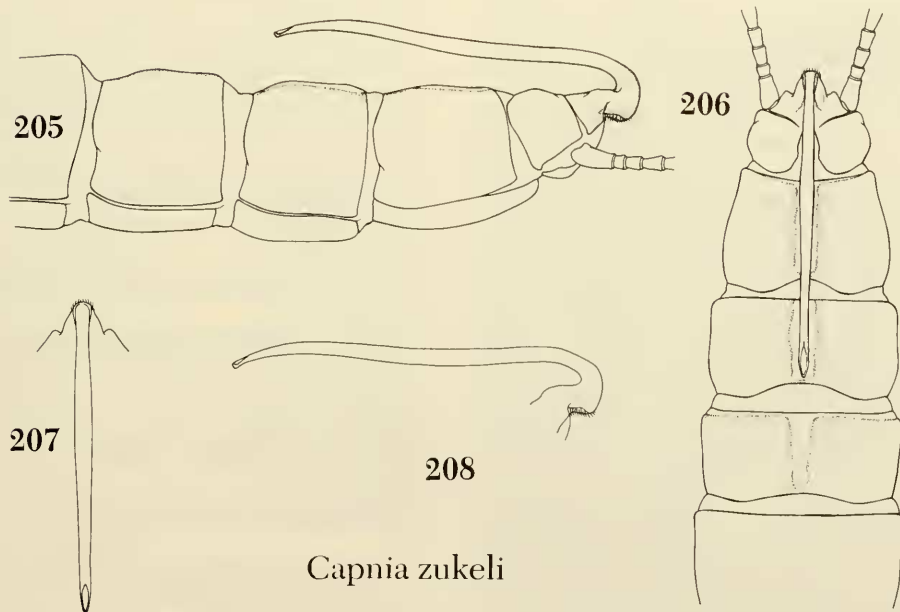
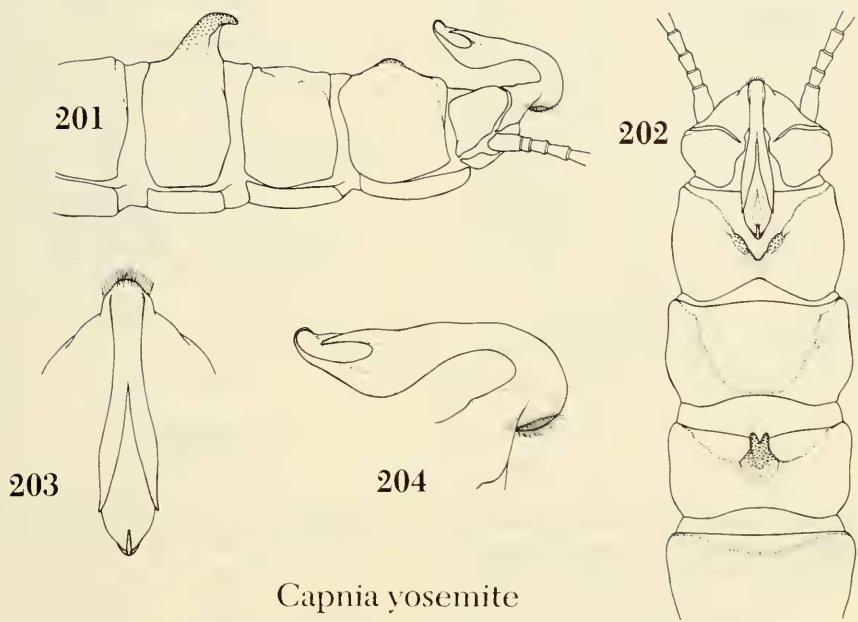
Capnia erecta Jewett

Map Fig. 272

Capnia erecta Jewett 1955: 147, 1959: 45. Illies 1966: 137.
Stark et al. 1986: 385.

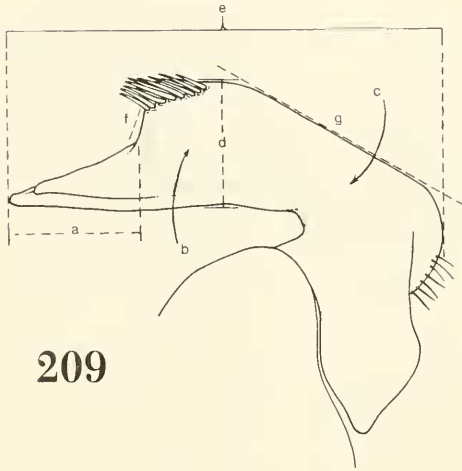
HOLOTYPE.—Male, Oregon; Josephine Co., Grave Creek, tributary of Rogue River, at Highway 99, 3 March 1950, S. G. Jewett, Jr.; (CAS).

DIAGNOSIS.—This species is represented by a single male specimen that differs from all other members of the genus in having the epiproct not completely curved back over the abdomen. The specimen may be teneral so that the epiproct has not yet fully reflexed over the abdomen in the normal position of that of other *Capnia*. The shape of the epiproct most closely resembles that of *C. willametta*, with which it may be conspecific. The epiproct has a few rear-directed bristles on the upward-facing surface. Similar bristles are seen in several members of the Nana group, including *C. licina* and *C. glabra*. Further collecting of specimens from the type locality would be desirable to ascertain the correct placement of this strange specimen.

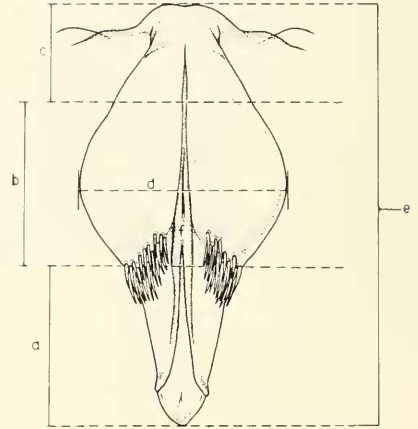


Figs. 201–204. *Capnia yosemite* Nelson & Baumann: 201, male terminalia, lateral; 202, male terminalia, dorsal; 203, male epiproct, dorsal; 204, male epiproct, lateral. California, Mariposa Co., Big Creek, Hwy 41, Summerdale Campground above Fish Camp, 18 March 1985, R. W. Baumann and C. R. Nelson.

Figs. 205–208. *Capnia zukeli* Hanson: 205, male terminalia, lateral; 206, male terminalia, dorsal; 207, male epiproct, dorsal; 208, male epiproct, lateral. Idaho, Latah Co., Little Boulder Creek, Little Boulder Creek Campground, 26 April 1985, R. W. Baumann and C. R. Nelson.



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Figs. 209–210. *Capnia decepta* (Banks): 209: male epiproct, lateral view; a, tip; b, bulb; c, neck; d, epiproct depth; e, epiproct length; f, anterior declivity; g, posterior declivity. 210: male epiproct, dorsal view; a, tip length; b, bulb length; c, neck length; d, epiproct width; e, epiproct length.

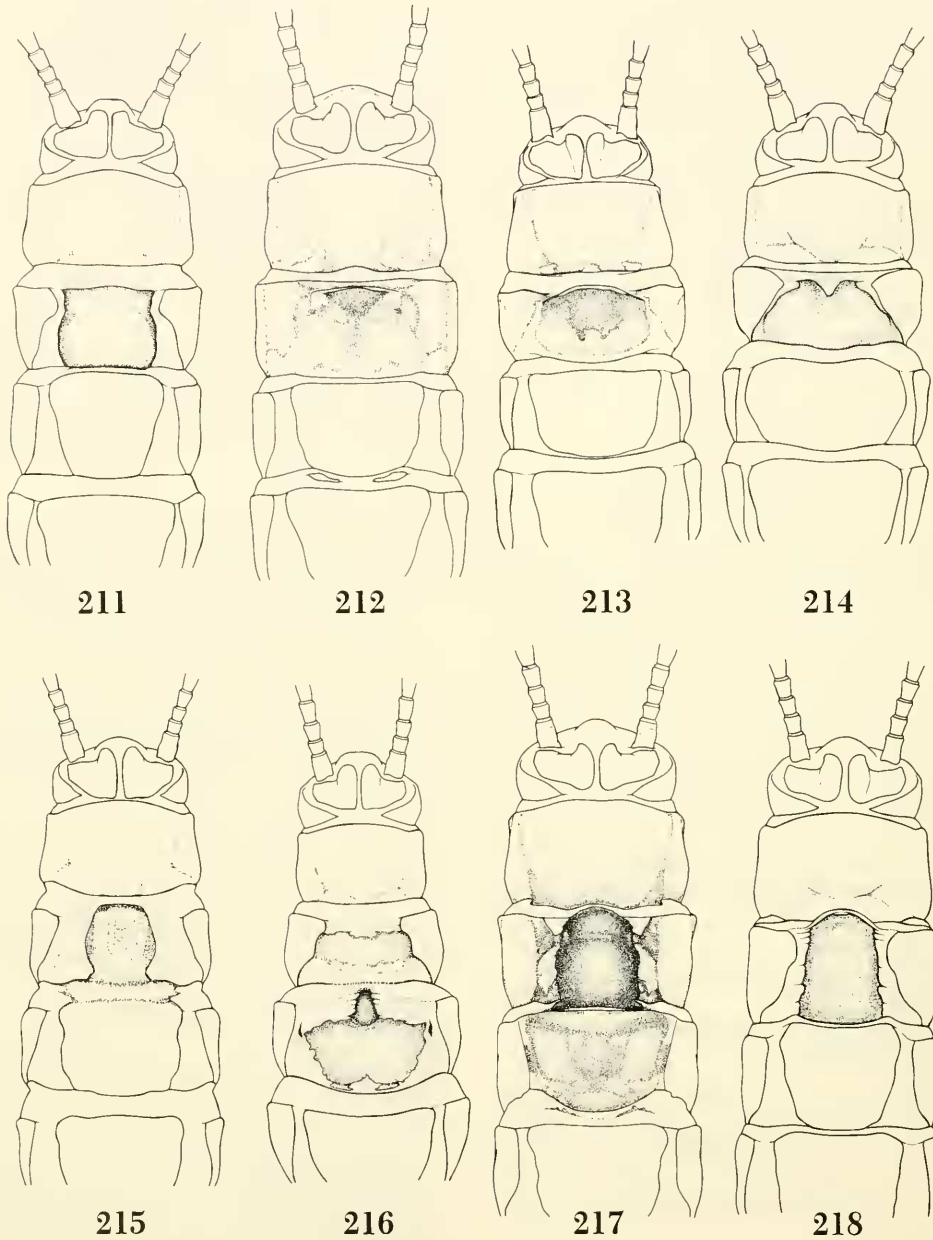
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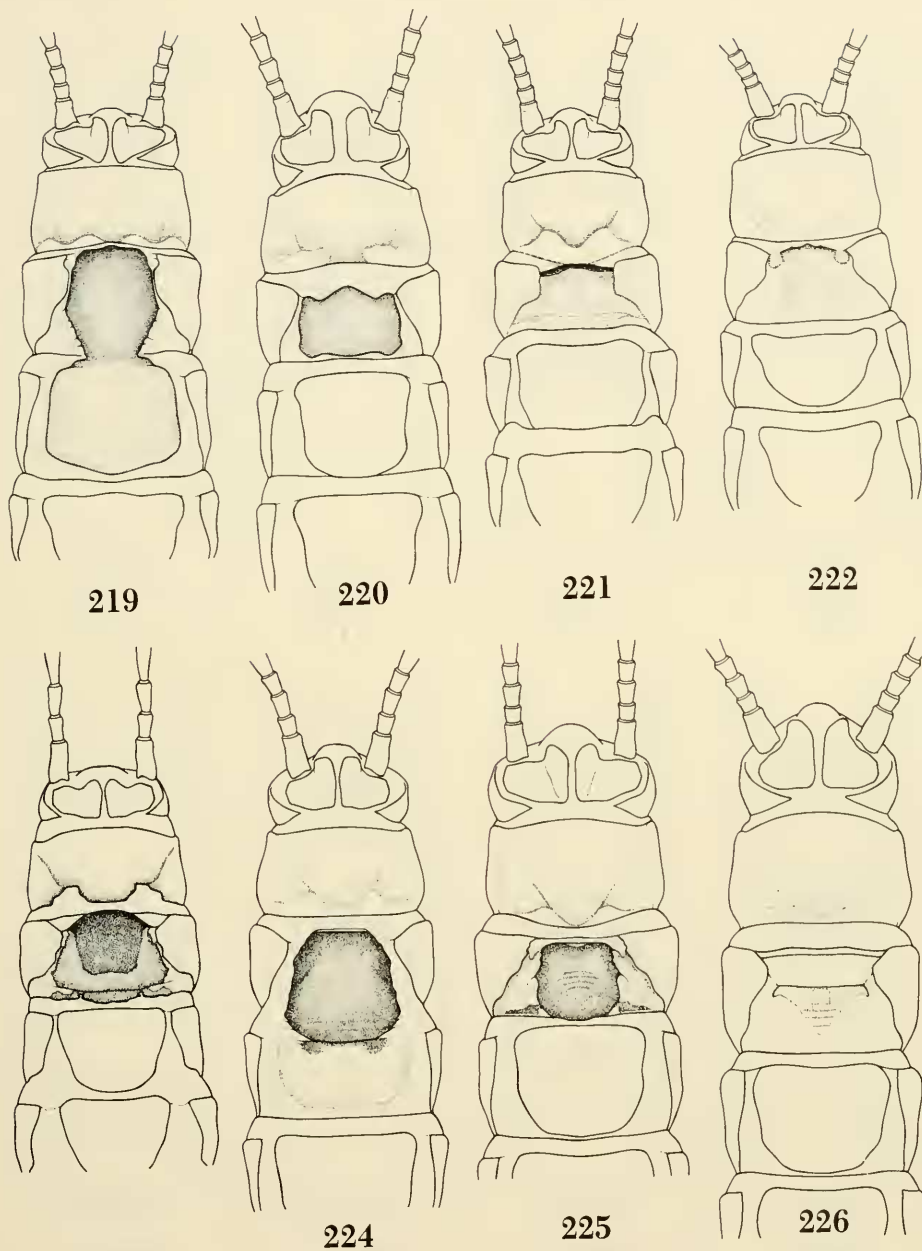
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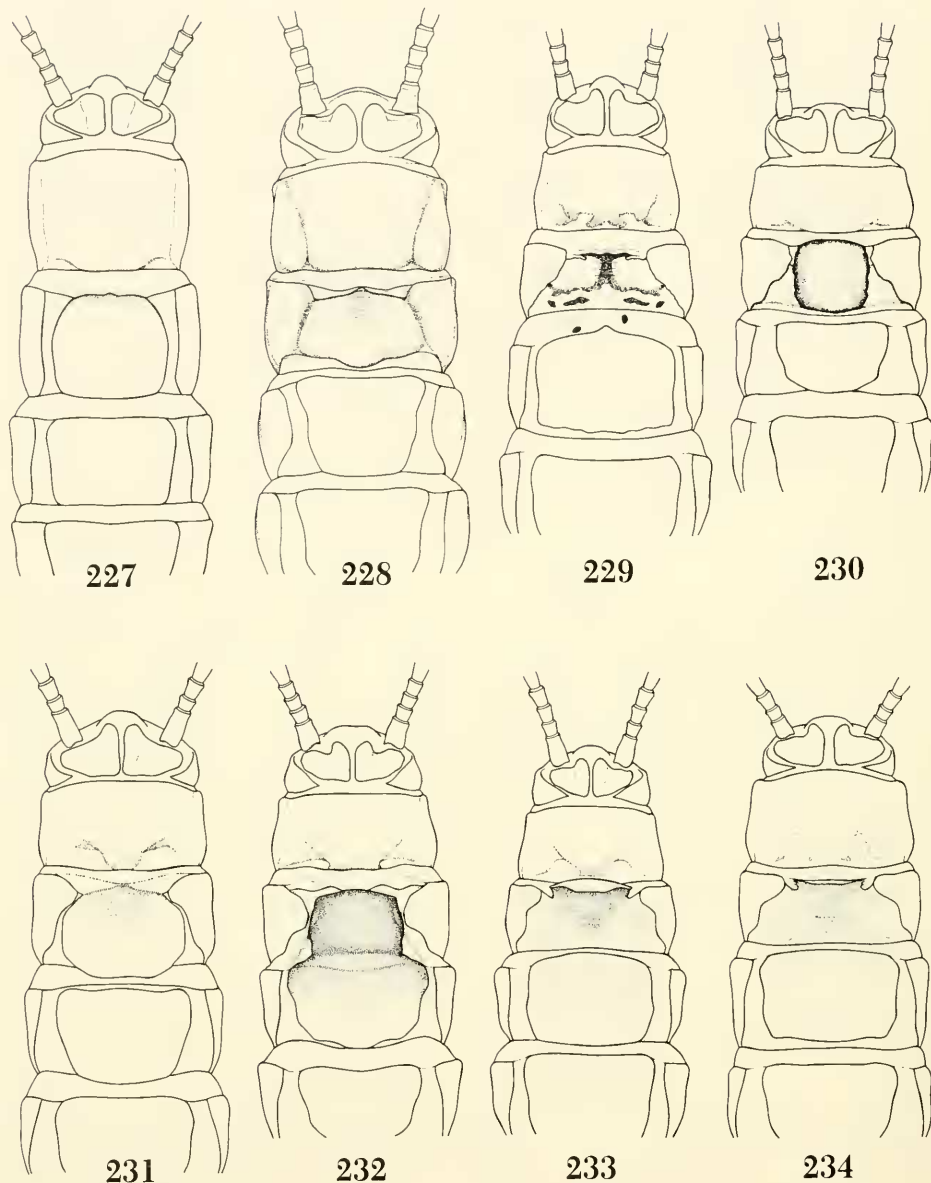
Figs. 211–214. *Capnia* spp.: 211, *C. barberi*, California, Plumas Co., Long Valley Creek, Hwy 70, Cromberg, 14 February 1985, R. W. Baumann and C. R. Nelson; 212, *C. californica*, California, Shasta Co., South Fork Clear Creek above Igo, 16 February 1985, R. W. Baumann and C. R. Nelson; 213, *C. californica*, Arizona, Gila Co., Strawberry Creek, Hwy 87, Strawberry, 14 January 1984, R. W. Baumann and C. R. Nelson; 214, *C. cheama*, Montana, Lincoln Co., Kootenai River, 19 March 1970, R. L. Newell.

Figs. 215–218. *Capnia* spp.: 215, *C. coloradenis*, Routt Co., Colorado, Willow Creek near Hahns Peak, 13 May 1968, B. R. Oblad; 216, *C. confusa*, Montana, Lincoln Co., Kootenai River, 28 March 1970, R. L. Newell; 217, *C. coyote*, California, San Bernardino Co., Seeley Creek, Hwy 138, Camp Seeley, 5,000 feet, 9 January 1988, R. W. Baumann, B. C. Kondratieff, C. R. Nelson, B. Sargent; 218, *C. decepta*, Arizona, Coconino Co., West Fork Oak Creek, near confluence with Oak Creek, 13 January 1984, R. W. Baumann and C. R. Nelson.



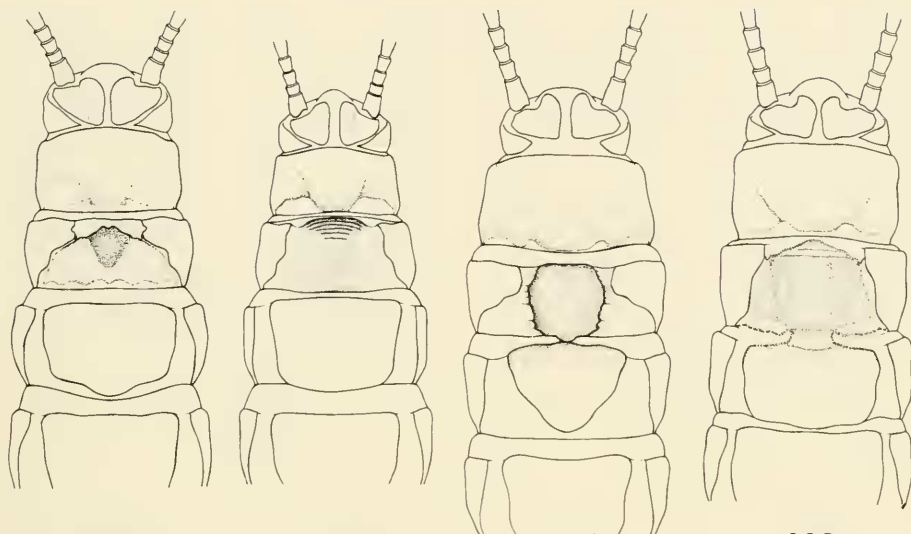
Figs. 219–222. *Capnia* spp.: 219, *C. elongata*, California, Placer Co., North Fork American River near Colfax, 21 February 1985, R. W. Baumann and C. R. Nelson; 220, *C. excavata*, California, Plumas Co., Mosquito Creek at junction North Fork Feather River, 14 February 1985, R. W. Baumann and C. R. Nelson; 221, *C. glabra*, California, Placer Co., Ward Creek, Hwy 89, near Lake Tahoe, 22 February 1985, R. W. Baumann and C. R. Nelson; 222, *C. gracilaria*, Montana, Missoula Co., Rattlesnake Creek above Greenough Park, Missoula, 17 March 1969, R. W. Baumann.

Figs. 223–226. *Capnia* spp.: 223, *Capnia hitchcocki*, California, Alameda/Santa Clara County line, Arroyo Mocho Creek, 20 miles south Livermore, San Antonio Valley Road, 19 March 1985, R. W. Baumann and C. R. Nelson; 224, *C. hornigi*, Nevada, Esmeralda Co., White Mountains, Middle Creek, 10 February 1977, A. L. Sheldon; 225, *C. inyo*, California, Inyo Co., Independence Creek, Grays Meadow Campground, 25 January 1985, R. W. Baumann and C. R. Nelson; 226, *C. jewetti*, Oregon, Clatsop Co., Clatskanie River, Olney, 15 February 1946, S. G. Jewett, Jr.



Figs. 227–230. *Capnia* spp.: 227, *C. lacustra*, California, El Dorado Co., Lake Tahoe, Emerald Bay, depth 116–198 feet, 11 July 1962, T. C. Frantz and A. J. Cordone; 228, *C. licina*, Oregon, Clackamas Co., Upper Salmon River, near junction Hwy 26 and State Road 35, 28 April 1984, G. R. Fiala; 229, *C. lineata*, Idaho, Latah Co., Little Boulder Creek, Little Boulder Creek Campground, 26 April 1985, R. W. Baumann and C. R. Nelson; 230, *C. mariposa*, California, Mariposa Co., Tuolumne River, Hwy 120, Tuolumne Meadows Campground, 27 June 1988, R. W. Baumann and J. A. Stanger.

Figs. 231–234. *Capnia* spp.: 231, *C. melia*, Oregon, Clackamas Co., Wildcat Creek, Hwy 36, 1 mile east of Alder Creek, 2 March 1984, R. W. Baumann, C. R. Nelson, and G. R. Fiala; 232, *C. mono*, California, Mono Co., Slinkard Creek, 2 miles north of Topaz, 5 November 1983, W. D. Shepard, reared from nymph in laboratory; 233, *C. nana nana*, British Columbia, Terrace, 1936, M. E. Hippisley; 234, *C. nana wasatchae*, Utah, Cache Co., Logan Canyon, Springhollow, tributary of Logan River, 4 January 1984, C. R. Nelson and S. A. Wells.

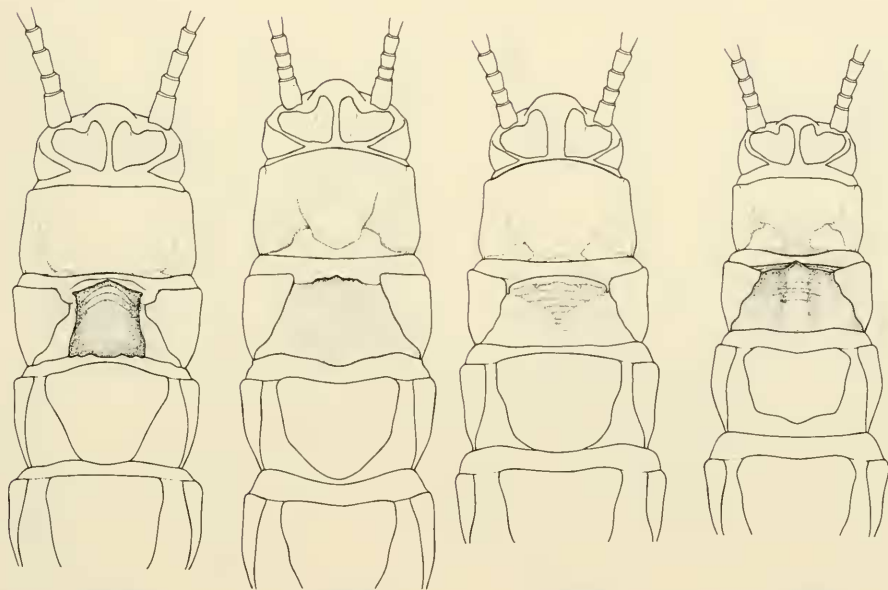


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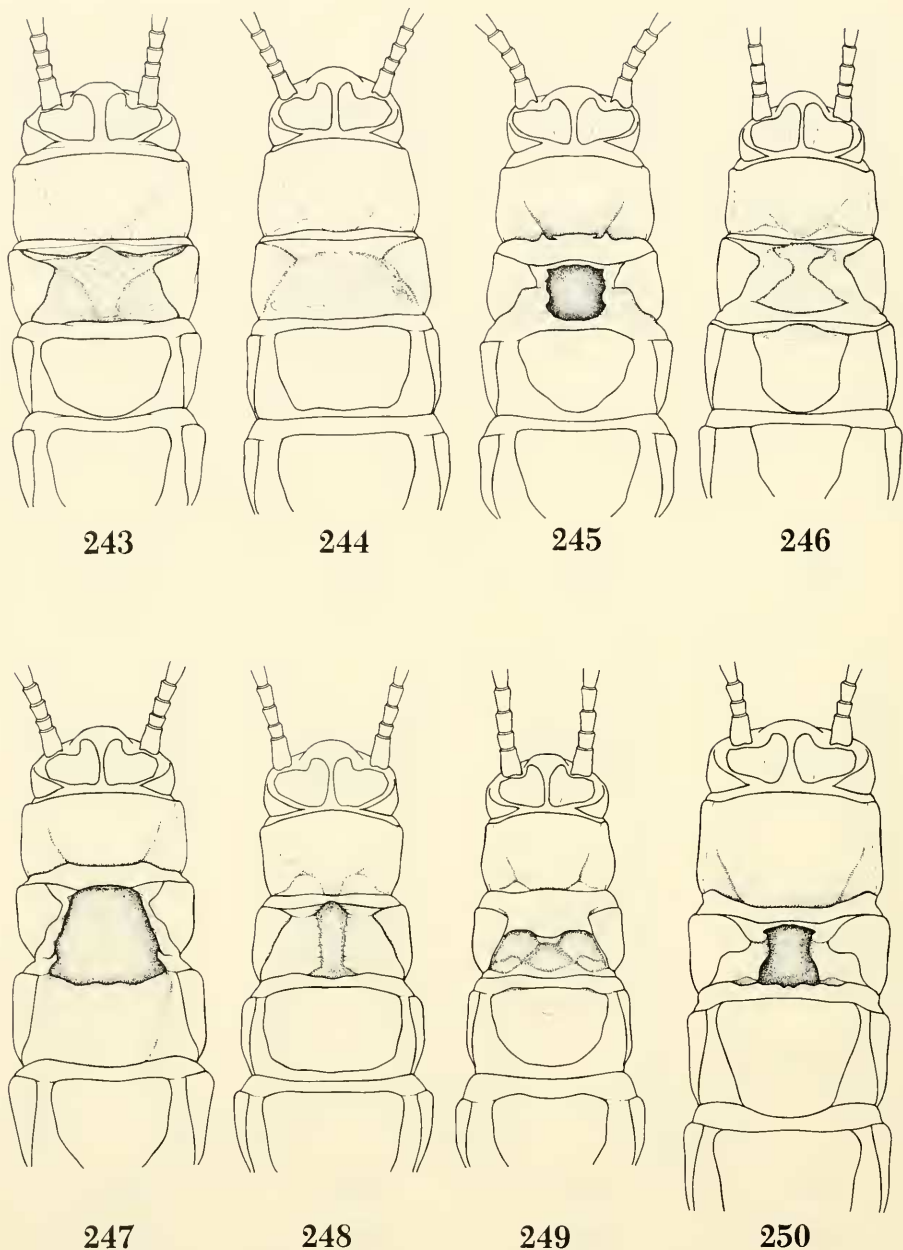
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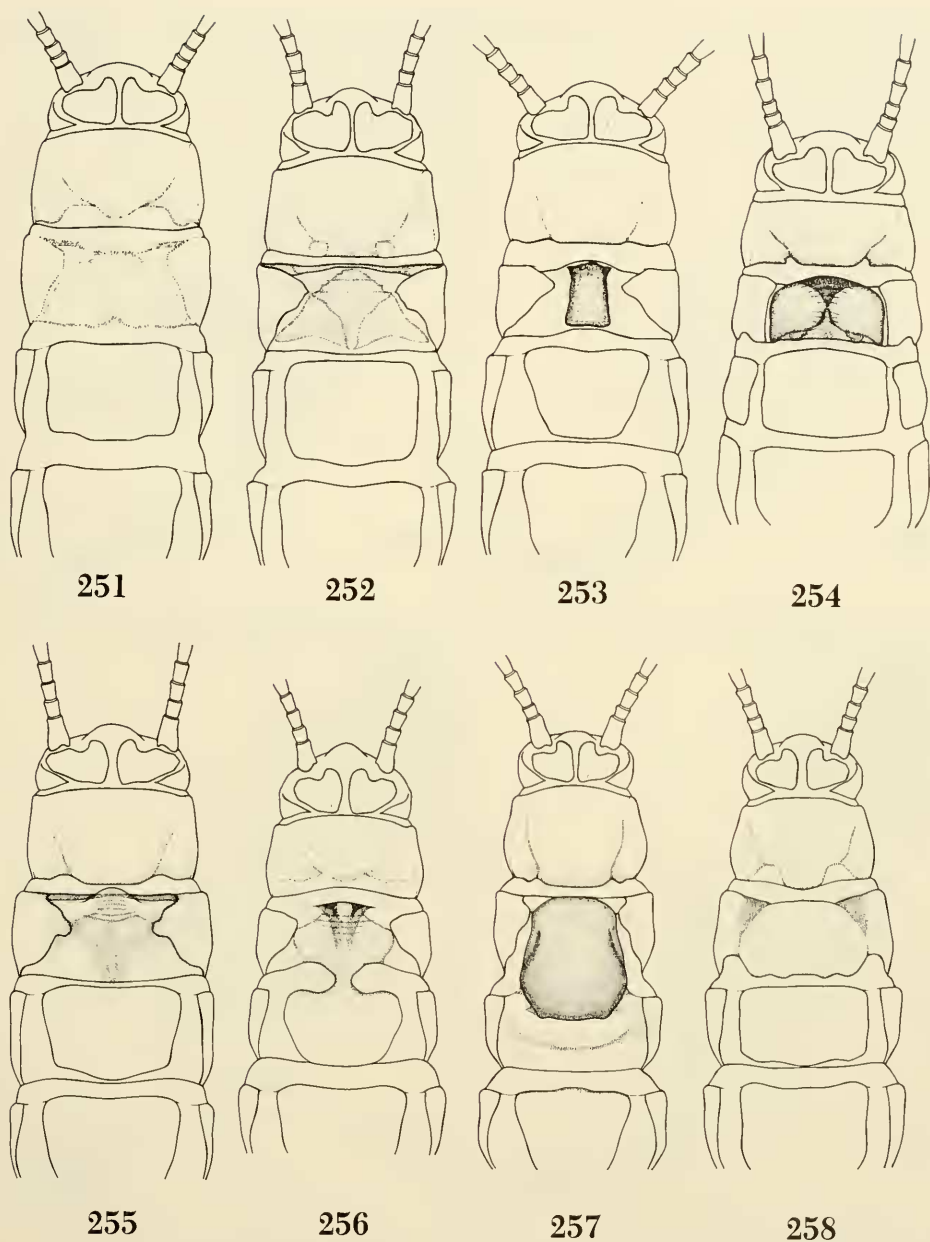
Figs. 235–238. *Capnia* spp.: 235, *C. nearctica*, Northwest Territories, Keewatin District, Baffin Island, Nettilling Lake, 6 July 1956; 236, *C. oregona*, Oregon, Linn Co., Gordon Meadows, 4,000 feet, 18 July 1959, H. Hacker; 237, *C. palomar*, California, San Diego Co., Palomar Mountain, Fry Creek, Road S–6, Fry Creek Campground, 18 January 1985, R. W. Baumann and C. R. Nelson; 238, *C. petila*, Utah, Box Elder Co., Raft River Mountains, Fisher Creek at mouth of canyon, 29 March 1979, R. W. Baumann and G. M. Webb.

Figs. 239–242. *Capnia* spp.: 239, *C. pileata*, Oregon, Clackamas Co., 0.6 miles north of Marquam, 15 January 1967, S. G. Jewett, Jr.; 240, *C. promota*, Oregon, Benton Co., Corvallis, Oak Creek, 1 January 1936.; 241, *C. quadrituberosa*, California, Butte Co., small stream north of Oroville near Garden Drive, 15 February 1985, R. W. Baumann and C. R. Nelson; 242, *C. regilla*, California, Marin Co., Bear Valley Creek, Point Reyes National Seashore, 25 May 1975, D. G. Denning.



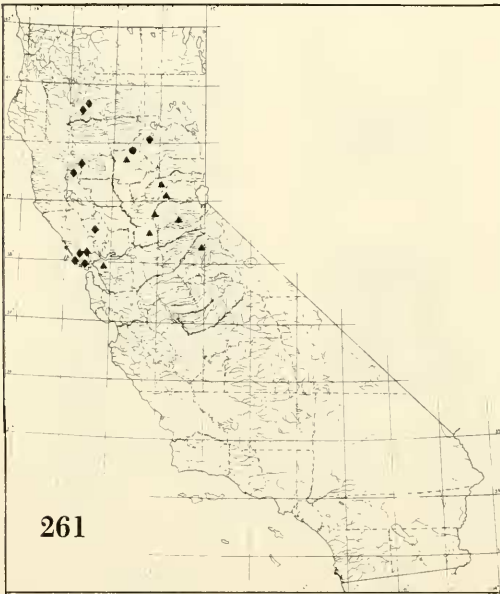
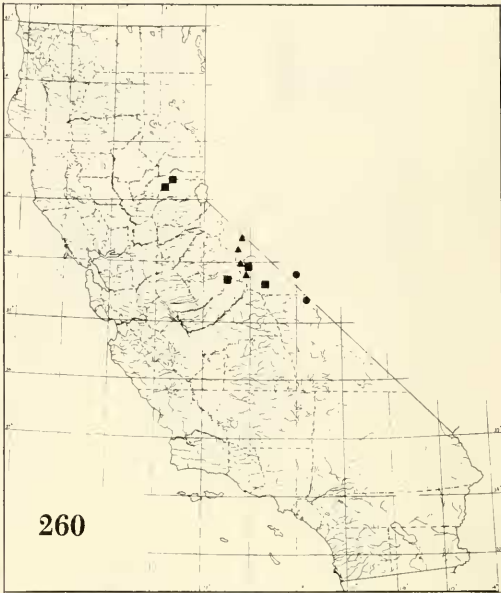
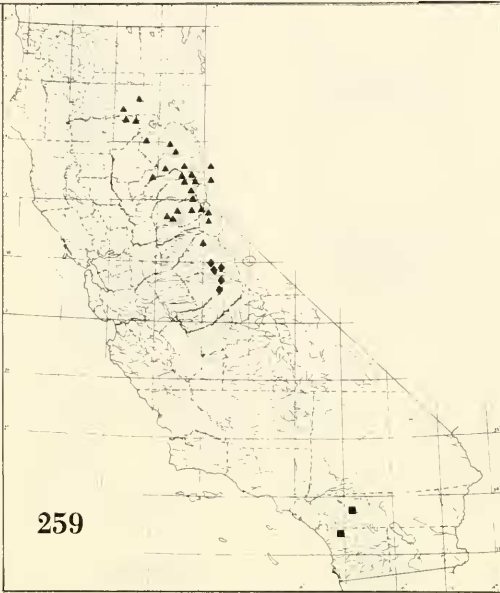
Figs. 243–246. *Capnia* spp.: 243, *C. saratoga*, California, near Saratoga, 25 February 1940, S. G. Jewett, Jr.; 244, *C. scobina*, California, Nevada Co., Sagehen Creek, 6,300 feet, 15 February 1965, A. L. Sheldon; 245, *C. sequoia*, California, Tuolumne Co., Ackerson Creek, Evergreen Lodge Road, 18 March 1985, R. W. Baumann and C. R. Nelson; 246, *C. sextuberculata*, Oregon, Wallowa Co., Lake Creek, junction Lostine River, Lostine Guard Station, 19 May 1977, R. W. Baumann and D. Dunster.

Figs. 247–250. *Capnia* spp.: 247, *C. shepardi*, California, Mono Co., Lee Vining Creek, Lee Vining Campground, 14 March 1985, R. W. Baumann and C. R. Nelson; 248, *C. spinulosa*, California, Los Angeles Co., San Gabriel Mountains, 0.5 miles northeast of Camp Valcrest, 24 April 1977, C. L. Hogue.; 249, *C. teresa*, California, San Bernardino Co., San Antonio Creek, at Mount Baldy Village, 22 January 1985, R. W. Baumann and C. R. Nelson; 250, *C. tumida*, California, Plumas Co., Big Grizzly Creek, junction tributary of Middle Fork Feather River, Hwy 70, 14 February 1985, R. W. Baumann and C. R. Nelson.

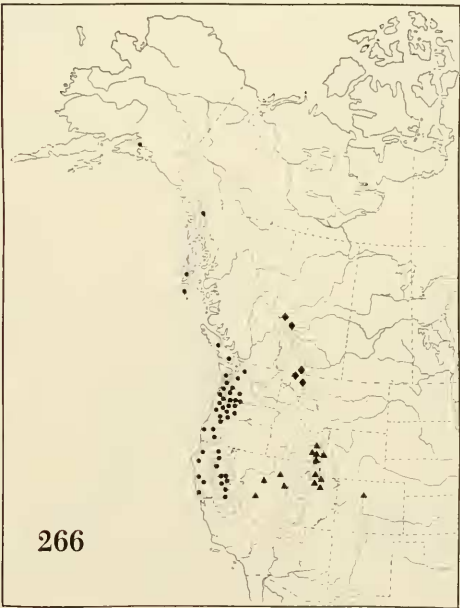
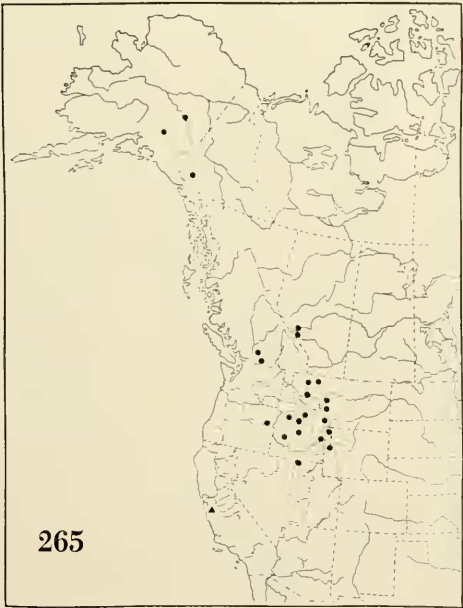
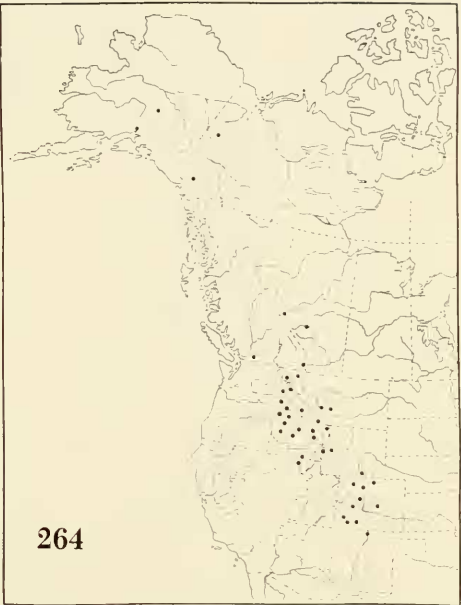
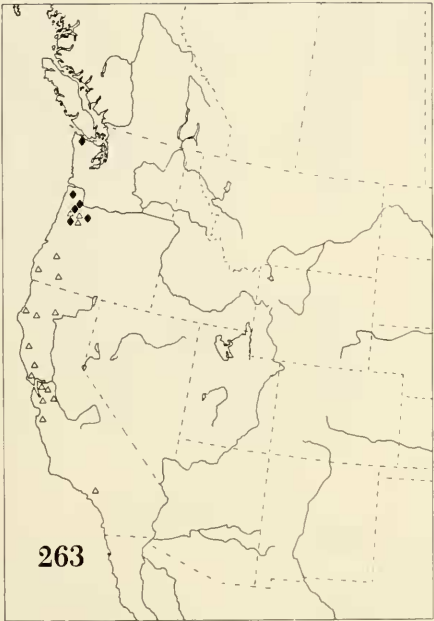


Figs. 251–254. *Capnia* spp.: 251, *C. nintali*, Utah, Wasatch Co., Provo River, Stewarts Ranch, 2 March 1949, A. R. Gaufin; 252, *C. unipqua*, California, Shasta Co., Sulphur Creek, Castle Crags State Park, 16 February 1985, R. W. Baumann and C. R. Nelson.; 253, *C. utahensis*, Utah, Beaver Co., South Creek, 0.5 miles south of Beaver, 21 February 1965, A. V. Nebeker; 254, *C. valhalla*, California, Los Angeles Co., San Gabriel Mountains, 0.5 miles east of Horseflat Road, 6 March 1977, C. L. Hogue, no. 229.

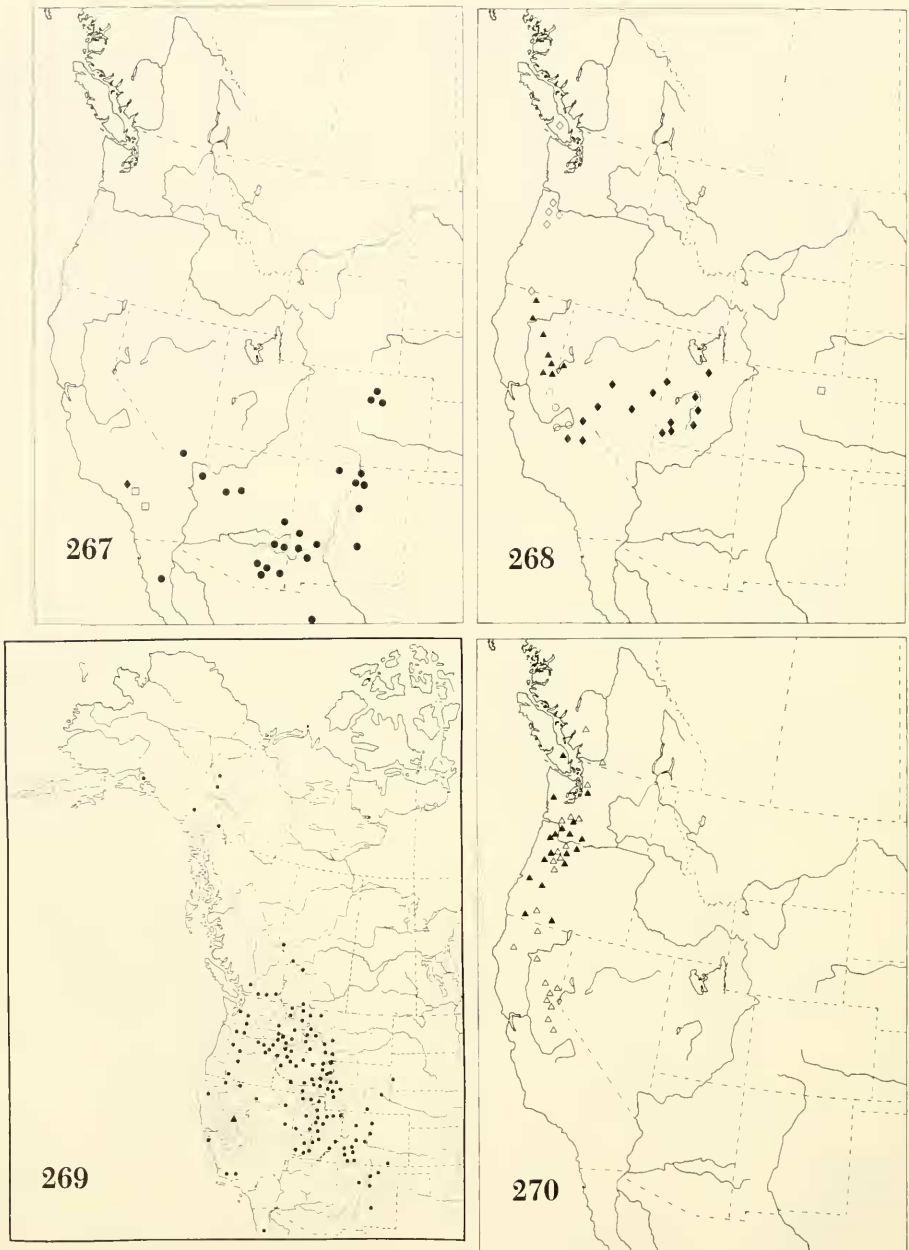
Figs. 255–258. *Capnia* spp.: 255, *C. ventura*, California, Ventura Co., Bear Creek, Wheeler Gorge Campground north of Ojai, 23 January 1985, R. W. Baumann and C. R. Nelson; 256, *C. vernalis*, Montana, Broadwater Co., Missouri River, Toston, 28 March 1952, R. Hays; 257, *C. yosemite*, California, Mariposa Co., Big Creek, Hwy 41, Summerdale Campground above Fish Camp, 18 March 1985, R. W. Baumann and C. R. Nelson; 258, *C. zukeli*, Idaho, Latah Co., Little Boulder Creek, Little Boulder Creek Campground, 26 April 1985, R. W. Baumann and C. R. Nelson.



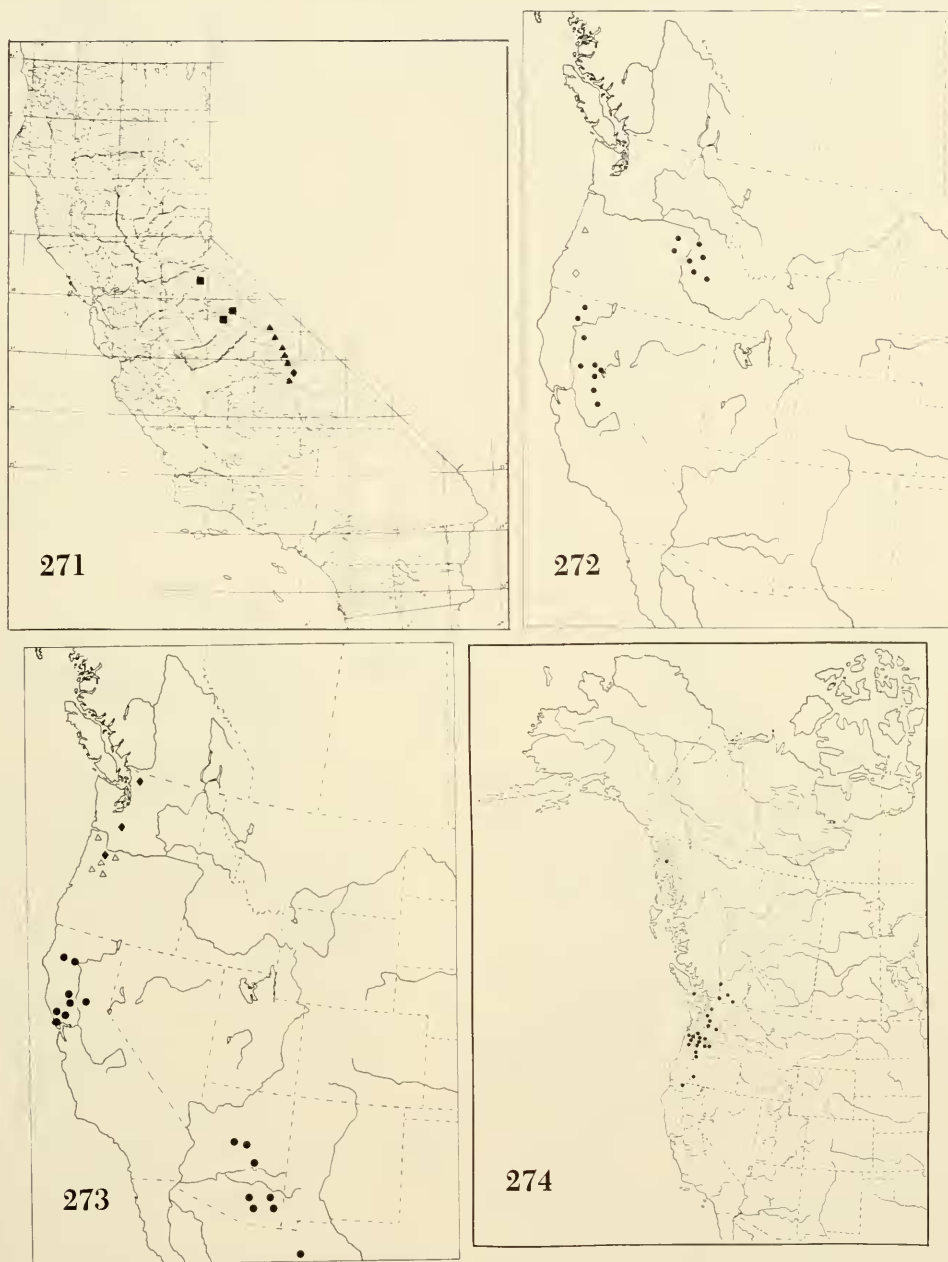
Figs. 259–262. Distributional maps *Capnia* spp.: 259, *C. barberi* solid triangles, *C. palomar* solid squares, and *C. yosemite* solid diamonds; 260, *C. hornigi* solid circles, *C. mono* solid triangles, and *C. shepardii* solid squares; 261, *C. californica* solid diamonds (California distribution, see Fig. 273 for complete distribution), *C. ophiona* solid circle, *C. quadrituberosa* solid triangles; 262, *C. regilla* solid circle, *C. saratoga* solid triangle, and *C. ventura* solid squares.



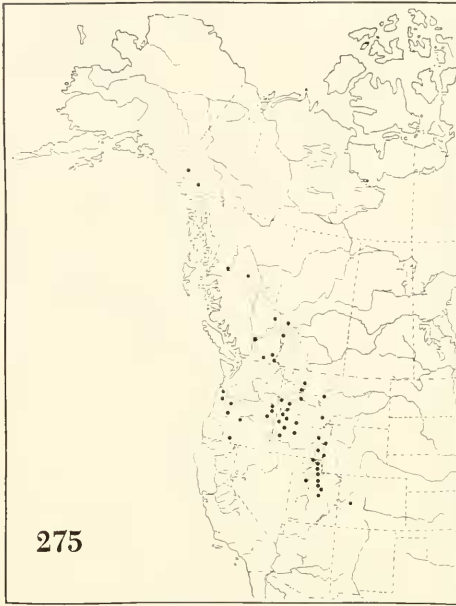
Figs. 263–266. Distributional maps *Capnia* spp.: 263, *C. jewetti* solid diamonds and *C. umpqua* open triangles; 264, *C. coloradensis* solid circles; 265, *C. hitchcocki* solid triangle, and *C. petila* solid circles; 266, *C. cheama* solid diamonds, *C. excavata* solid circles, and *C. uintahi* solid triangles.



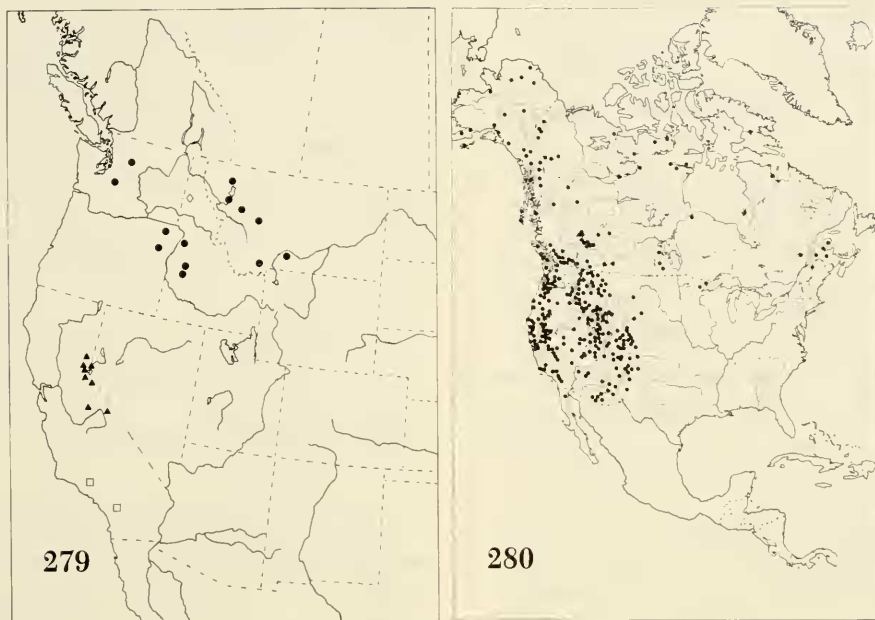
Figs. 267–270. Distributional maps *Capnia* spp.: 267, *C. coyote* solid diamond, *C. decepta* solid circles, and *C. teresa* open squares; 268, *C. arapahoe* open square, *C. pileata* open diamonds, *C. sequoia* open circles, *C. tumida* solid triangles, and *C. utahensis* solid diamonds; 269, *C. gracilaria* solid circles and *C. lacustra* solid triangle; 270, *C. elongata* open triangles and *C. promota* solid triangles.



Figs. 271–274. Distributional maps *Capnia* spp.: 271, *C. giulianii* solid diamond, *C. inyo* solid triangles, and *C. mariposa* solid squares; 272, *C. erecta* open diamond, *C. glabra* solid circles, and *C. willametta* open triangle; 273, *C. californica* solid circles (total distribution, see Fig. 261 for detailed California distribution), *C. licina* solid diamonds, and *C. oregona* open triangles; 274, *C. melia* solid circles.



Figs. 275–278. Distributional maps *Capnia* spp.: 275, *C. nana* solid circles; 276, *C. uearctica* solid circles and *C. valhalla* solid triangles; 277, *C. confusa* solid circles; 278, *C. lineata* solid triangle and *C. vernalis* solid circles.



Figs. 279–280. Distributional maps *Capnia* spp.: 279, *C. scobina* solid triangles, *C. sextuberculata* solid circles, *C. spinulosa* open squares, and *C. zukeli* open diamond; 280, total recorded distribution of the genus *Capnia* in the Nearctic region solid circles.

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